

VER 1.1

Reference Manual

DS-BVS/BVM-Series



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1. Introduction

The purpose of this document is to familiarize readers with safe, proper installation and test run of the described device.

Follow the guidelines to avoid hazardous situations, improve the device reliability and lifespan, and minimize the installation and test run time.

This document provides detailed information about firmware and contains descriptions of the device architecture, device state, operating mode, error handling, and the object.

2. EtherCAT Communication

EtherCAT, the abbreviation of Ethernet for Control Automation Technology, is a real-time Ethernet-based fieldbus system created by Beckhoff Automation, Germany.

EtherCAT uses a standard Ethernet packet or its slightly modified frame structure.

With EtherCAT, the standard Ethernet packet frame no longer has to be received, interpreted, and copied as data to be processed at every node.

The fundamental idea of EtherCAT communication is that the slave reads the data addressed to it and processes the data instantaneously while data frame sent from the master passes through the slave. Similarly, additional data are immediately inserted in each slave while the frame passes through. In general, the entire network can be addressed with just a single data frame.

3. CANopen Communication Profile (CiA DS 301)

CANopen protocol standard defines several CAN message types for data exchange, network management, and reporting device errors. All message types for data exchange are allowed to access the CANopen object dictionary.

Message Type	Description	Default CAN-Identifiers
NMT	Network Management Telegram These telegrams are sent from the master to the slave nodes in order to control the network state of the slaves. - Highest priority CAN identifier - Broadcast message from master to all slaves Possible states of a CANopen device: stopped, preoperational, operational.	0x00
SDO	Service Data Object These telegram type is used to exchange configuration data. - Used in device states preoperational and operational - Lower priority CAN identifier - Mainly used during bus start up. - Each telegram is initiated from master node. - Each telegram is answered, so transfer is slowly. - There is only one object (data from object dictionary) that can be exchanged - Data is addressed using index and sub index.	0x600 + Node-ID 0x580 + Node-ID
PDO	Process Data Object These telegram type is used to transfer process data (for example digital input bitmap) - High priority CAN identifier - PDOs may only be transmitted in operational device state. - Predefined data content of max. 8 bytes. No addressing using index and sub index. - Data transfer may be initiated from each node. - Data transfer is not answered	0x180 + Node-ID ... 0x480 + Node-ID 0x200 + Node-ID ... 0x500 + Node-ID
EMCY	Emergency Message These telegrams are sent in order to indicate an error condition of the device. - High priority CAN identifier	0x80 + Node-ID

SYNC	<p>Synchronization Message</p> <p>This telegram is sent from master to all slaves, in order to synchronize exchanging of process data with hardware and in order to cause transmission of PDOs</p> <ul style="list-style-type: none"> - High priority CAN identifier - Message without any data content 	0x80
Boot-Up	<p>Boot Up Message</p> <p>This telegram type is used to indicate, that a node has performed a reset and is no ready to take part within the network communication.</p> <ul style="list-style-type: none"> - Low priority CAN identifier - Sent only once after node has performed reset procedure. 	0x700 + Node-ID
Error-Control	<p>Error-Control Protocol</p> <p>These telegram types are used to monitor the device state. The protocols are used to detect breakdowns of slaves or the master in order to enter fail safe condition states.</p> <p>There are two types of Error-Control Protocols:</p> <ul style="list-style-type: none"> - Node-Guarding / Life Guarding : The master polls each slave individually. The slave sends an answer protocol if still alive. - Heartbeat : Each node periodically transmits its NMT state. 	0x700 + Node-ID

3.1 Default Identifier

Default identifier assignment involves saving the configuration. Therefore, the CAN identifier is based on the node ID number of the device. The CAN identifier assignment can be defined as follows.

Identifier (hex)	Message Type	Communication
0	NMT : Network Management Message	CAN only
0x80	SYNC : Synchronization Message	CAN only
0x81 to 0xFF (0x80 + Node-ID)	EMCY : Emergency Message	CAN only
0x181 to 0x1FF (0x180 + Node-ID)	Transmit Process Data Object 1 (TPDO1)	CAN only
0x201 to 0x27F (0x200 + Node-ID)	Receive Process Data Object 1 (RPDO1)	CAN only
0x281 to 0x2FF (0x280 + Node-ID)	Transmit Process Data Object 2 (TPDO2)	CAN only
0x301 to 0x37F (0x300 + Node-ID)	Receive Process Data Object 2 (RPDO2)	CAN only
0x381 to 0x3FF (0x380 + Node-ID)	Transmit Process Data Object 3 (TPDO3)	CAN only
0x401 to 0x47F (0x400 + Node-ID)	Receive Process Data Object 3 (RPDO3)	CAN only
0x481 to 0x4FF (0x480 + Node-ID)	Transmit Process Data Object 4 (TPDO4)	CAN only
0x501 to 0x57F (0x500 + Node-ID)	Receive Process Data Object 4 (RPDO4)	CAN only
0x581 to 0x5FF (0x580 + Node-ID)	SDO send	CAN only
0x601 to 0x67F (0x600 + Node-ID)	SDO receive	CAN only
0x701 to 0x77F (0x700 + Node-ID)	Boot Up and Error Control Protocol	CAN only

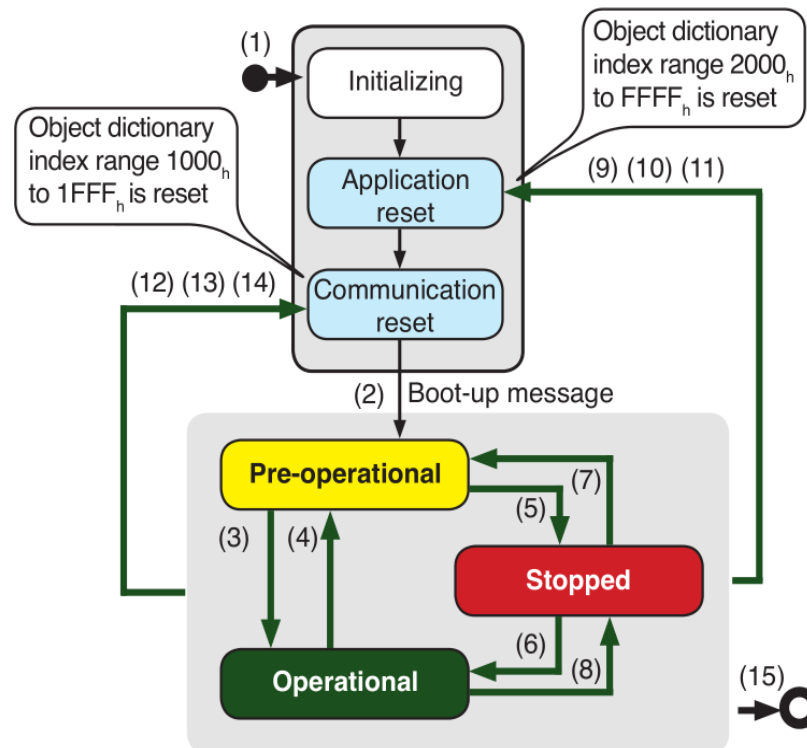
3.2 Network Management (NMT)

CANopen master uses multiple NMT messages to control the network state of all nodes. NMT messages have the highest priority identifier (CAN-ID 0) and always use two bytes of data.

	Identifier (hex)	Data Byte 0	Data Byte 1
NMT Message	0x0000	NMT Command	Slave Node-ID

The first data byte contains the NMT command that switches the network state, and the second data byte contains the CANopen slave Node-ID (address). If the slave Node-ID is 0, all connected slave nodes have to process the NMT

NMT Command Value	Command	Description
0x01	OP (Operational)	Switches to Operational state enables PDO transfer. Typically the operational state with PDO transfer is the network state for running systems after the master has finished initialization of all slaves.
0x02	STOP (Stop Node)	In status stopped, no PDO and no SDO communication is allowed.
0x80	PREOP (PreOperational)	Switches to Operational state. In Preoperational state no PDO, but only SDO transfer is allowed. After device start up, a CANopen node switches to PreOperational state automatically. This is the typical network state during initialization procedure.
0x81	RESET (Reset Node)	Performs a complete reset of the CANopen device
0x82	RESET COMM (Reset Communication)	Resets all objects from object dictionary that hold communication relevant parameters to default values



- (1) Power on
- (2) Automatic switch to Pre-operational
- (3) and (6) NMT switch to Operational
- (4) and (7) NMT switch to Pre-operational
- (5) and (8) NMT switch to Stopped
- (9), (10) and (11) NMT switch to Application reset
- (12), (13) and (14) NMT switch to Communication reset
- (15) Power-off or hardware reset

CANopen NMT State Diagram

3.3 Emergency Message (EMCY)

For the Emergency Message, the CANopen device reports any changes in the error state to the bus. The Emergency Message is always 8 byte long.

Identifier	BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
0x80 + Node-ID	EMCY Code		Error Reg.	Manufacturer specific error code				

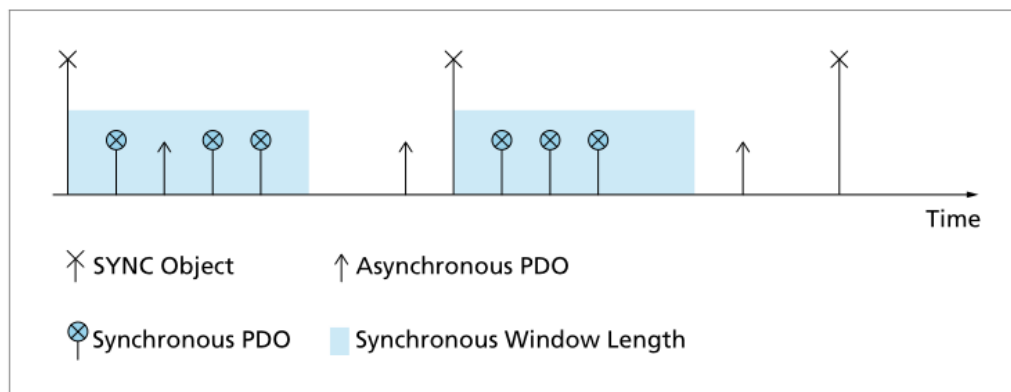
EMCY Code : emergency error code. The EMCY code is defined in the Draft Standard DS301.

Error Reg. : error register. The error register is displayed as an object (0x1001) within the device object dictionary. This object is also inserted in the emergency message.

A CANopen device sends an emergency message if an error is detected in the setting or resetting.

3.4 Synchronization Telegram (SYNC)

SYNC message is broadcast to all slaves from the CANopen master. The SYNC message enables an application program, or vice versa, to perform synchronous data transfer in the object library. For example, with the SYNC messages, reading of digital input pins can be triggered for all CANopen devices. The SYNC message typically uses CAN identifier 0x00 indicating NO DATA. SYNC telegram only operates in the Process Data Object (PDO) of the slave device configured for synchronous transmission within the PDO communication parameters.



Identifier	BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
0x80	No data							

3.5 Error Control Protocols and Boot-Up Message

Error control protocols enable the monitoring of a node status. These protocols play an important role in switching the system status to a non-critical state in case of a single node or bus line failure. For example, the drive must halt motions in the event of a PLC crash. The Error control protocols use the CAN telegram as a data byte that reports the node NMT status and the CAN identifier $0x700 + \text{Node-Id}$.

Identifier	BYTE 0
$0x700 + \text{Node-ID}$	NMT-State

The NMT State is reported as follows:

- 0x00 : Boot-Up Message
- 0x05 : Operational
- 0x7F : Preoperational

There are three types of error control protocols.

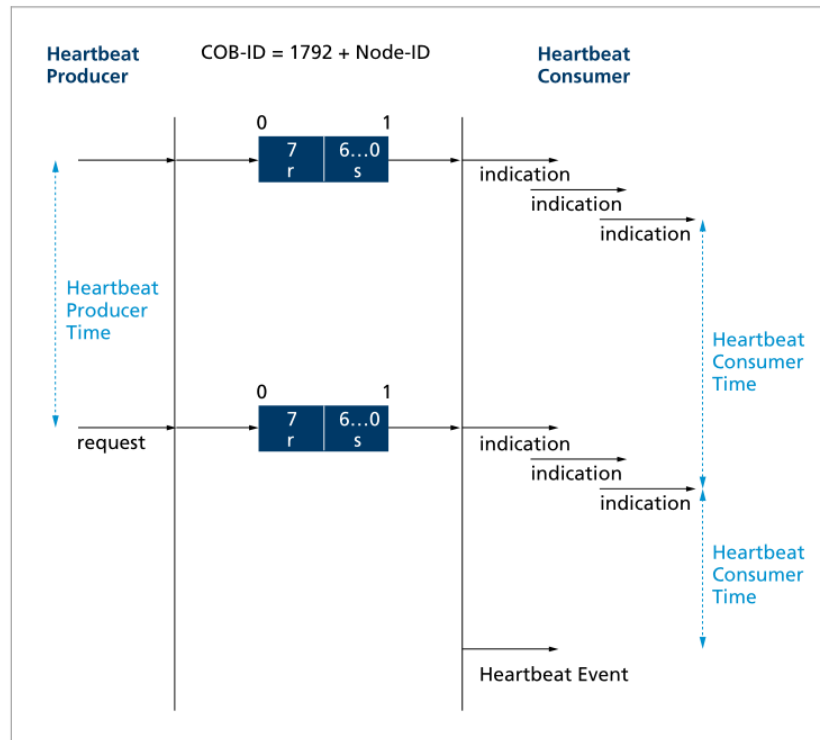
3.5.1 Boot-Up Message

Boot-Up message is a special version of error control protocols with NMT state 0x00. This message is sent exactly once after a reset sequence is performed or a node is initiated to inform the boot-up of all nodes in the CANopen network.

3.5.2 Heart Beat Message

With Heart Beat protocol, each node periodically transmits its error control message to the bus. There is no polling and so on. The Heart Beat protocol allows only a receiver to monitor the heartbeat producer node.

For the Heart Beat protocol to be configured, each CANopen device contains one object embodied in the object library for each direction. In order to activate the transmission or monitoring of a Heartbeat message, such object must be initialized from the master node in the network boot process.



< Flow diagram of the heartbeat protocol >

3.5.2.1 Consumer Heartbeat Time

Object Index	Sub-Index	Parameter	Description
0x1016	Consumer Heartbeat Time : Configures monitoring incoming heart beat messages.		the CAN identifier and time period for monitoring incoming heart beat messages.
	0	Number of entries	Number of valid sub index for this object
	1	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 consumer heartbeat time is 0, the corresponding entry is not used. The time period must be a multiple of 1 ms.

3.5.2.2 Consumer Heartbeat Time data

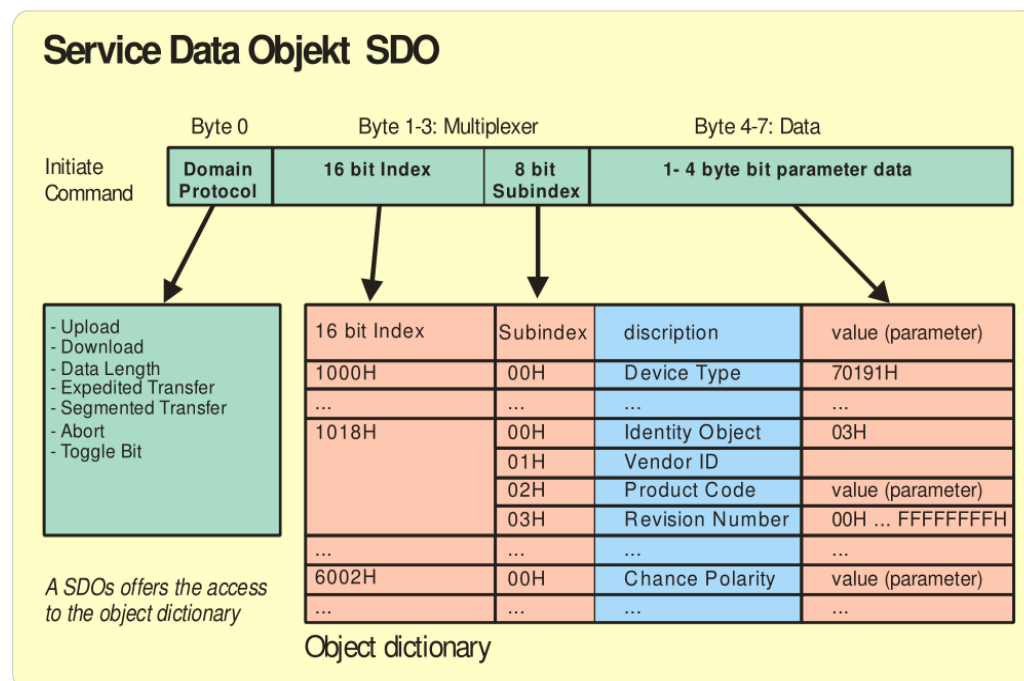
UINT32 / Bits	MSB 31..24	23...16	15..0 LSB
Value	0	Node-ID	Heartbeat time, in milliseconds
Encoding	-	UINT8	UINT16

3.5.2.3 Producer Heartbeat Time

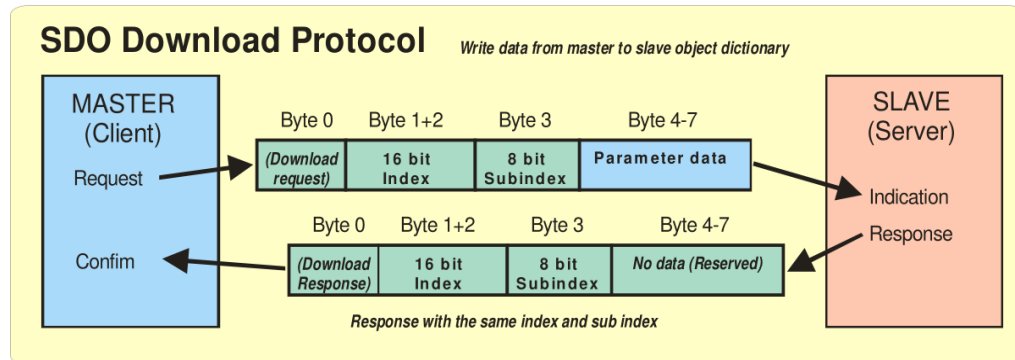
Object Index	Sub-Index	Parameter	Description
0x1017	Producer Heartbeat Time : Configures the time period for transmitting heart beat messages.		
	0	Consumer Heartbeat Time	This object defines the cycle time of the heartbeat, which must be a multiple of 1 millisecond. It is 0 if not used.

3.6 Service Data Object (SDO)

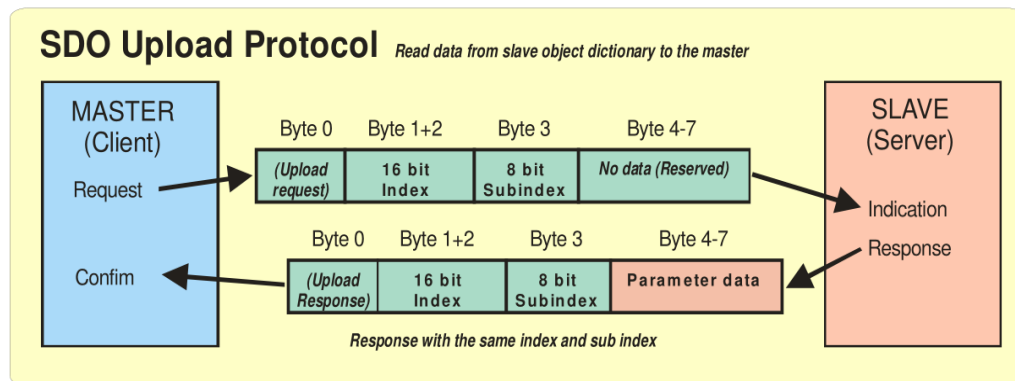
SDO is an access to a single object in the object library by using the object index and sub-index as an address (also called multiplexer). It always uses 8 data bytes of the CAN message. SDO is always initiated at the CANopen bus master, and the response is taken from the slave node. The basic structure of SDO shows how to use the CAN telegram data bytes.



3.6.1 SDO Download Protocol



3.6.2 SDO Upload Protocol



3.7 Process Data Object (PDO)

CANopen-based Process Data exchange is performed by standard CAN messages without protocol overhead. Each PDO contains a configuration object to specify the PDO transmission mode as well as a mapping object that predefines the content of the PDO data. A PDO message supports data transfer up to 8 bytes.

PDO transmission can be initiated in multiple modes.

- asynchronous PDO transmission is initiated by an event (e.g. altering the mapped data)
- synchronous PDO transmission is initiated by the SYNC message
- periodic PDO transmission is initiated with the event timer, triggering the transmission cyclically
- polling PDO transmission is initiated if the node has received a remote frame with the same CAN identifier

3.7.1 PDO Communication Parameters

Each PDO has a setting object that defines the communication parameters, such as the CAN object identifier and the transmission mode, for the corresponding PDOs. The communication parameters are using data type record.

Object Index	Sub-Index	PDO	Parameter	Description
0x1400 to 0x1403	0	RPDO	Number of entries	Number of valid sub index for this object
	1	RPDO	COB-ID used by Receive PDO#1~#4	0x1400 : RPDO1 0x1600 COB-ID = 0x200 0x1401 : RPDO2 0x1601 COB-ID = 0x300 0x1402 : RPDO3 0x1602 COB-ID = 0x400 0x1403 : RPDO4 0x1603 COB-ID = 0x500
	2	RPDO	Transmission Type of Receive PDO#1~#4	0 : Synchronous transmission performed once, at next SYNC. N=1…240 : Synchronous transmission performed once per $0 < N \leq 240$ accepted SYNC signals. 254 : Asynchronous transmission in response to a manufacturer-specific event. 255 : Asynchronous transmission in response to a device profile (such as DSP 402).
0x1800 to 0x1803	0	TPDO	Number of entries	Number of valid sub index for this object
	1	TPDO	COB-ID used by Transmit PDO#1~#4	0x1800 : TPDO1 0x1A00 COB-ID = 0x40000180 0x1801 : TPDO2 0x1A01 COB-ID = 0x40000280 0x1802 : TPDO3 0x1A02 COB-ID = 0x40000380 0x1803 : TPDO4 0x1A03 COB-ID = 0x40000480
	2	TPDO	Transmission Type of Transmit PDO#1~#4	0 : Synchronous transmission performed once, at next SYNC. N=1…240 : Synchronous transmission performed once per $0 < N \leq 240$ accepted SYNC signals. 254 : Asynchronous transmission in response to a manufacturer-specific event. 255 : Asynchronous transmission in response to a device profile (such as DSP 402).
	3	TPDO	Inhibit Time of Transmit PDO#1~#4	0 : no inhibit time between messages - Inhibit time specifications do not relate to the generating event but to the transmission of the TPDO. The inhibit time resolution is 100 microseconds. The exact inhibit times are not very accurate and can actually be up to 2 milliseconds (20 units of inhibit time) longer than defined by sub-index 3 of this object. For example, if an inhibit time is specified as 10 milliseconds, its actual inhibit time length may vary in the range of [10…12] milliseconds.
	4	TPDO	Reserved	-

5	TPDO	Event Timer of Transmit PDO#1~#4	0 : Not used - When a TPDO transmission type is 254 or 255, an event time can be used. The event occurs when the time is elapsed. The event time elapse is a multiple of 1 millisecond of sub-index 5. It causes the transmission of this PDO in addition to other asynchronous events. The occurrence of an event sets the timer again. A value of 0 disables this function. The transmission of the TPDO has an accuracy with 2 milliseconds.
---	------	----------------------------------	--

3.7.2 PDO Mapping Parameters

PDO mapping allows the data contents of a PDO to be preconfigured in the mapping table. This mapping table contains information on the index, sub-index, and data size of each object that is transmitted within a PDO message.

The mapping table for each PDO is represented as an object within the device object dictionary. The table is displayed as an array of mapped objects.

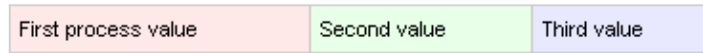
Object Index	Sub-Index	PDO	Parameter	Description
0x1600 to 0x1603	0	RPDO	Number of entries	Number of valid sub index for this object
	1~10	CAN EtherCAT	RxPDO#1~#4 Mapping Parameter#1~#10	Shows index, sub index and data size given in bits, of a mapped object, that is transferred within the PDO message
0x1604 to 0x1609	0	RPDO	Number of entries	Number of valid sub index for this object
	1~10	EtherCAT only	RxPDO#5~#10 Mapping Parameter#1~#10	Shows index, sub index and data size given in bits, of a mapped object, that is transferred within the PDO message
0x1A00 to 0x1A03	0	TPDO	Number of entries	Number of valid sub index for this object
	1~10	CAN EtherCAT	TxPDO#1~#4 Mapping Parameter#1~#10	Shows index, sub index and data size given in bits, of a mapped object, that is transferred within the PDO message
0x1A04 to 0x1A09	0	TPDO	Number of entries	Number of valid sub index for this object
	1~10	EtherCAT only	TxPDO#5~#10 Mapping Parameter#1~#10	Shows index, sub index and data size given in bits, of a mapped object, that is transferred within the PDO message

3.7.2.1 PDO Mapping Example

TxPDO - Mapping table on the transmission side at [1A00]

The table contains three entries	03
1. Object [2345sub67] - 32 bits	23456720
2. Object [6000sub01] - 8 bits	60000108
3. Object [2001sub00] - 16 bits	20010010

PDO message



RxPDO - Mapping table on the reception side at [1600]

The table contains three entries	03
1. Object [5432sub10] - 32 Bits	54321020
2. Object [6200sub02] - 8 Bits	62000208
Empty entry - Word dummy	00060010

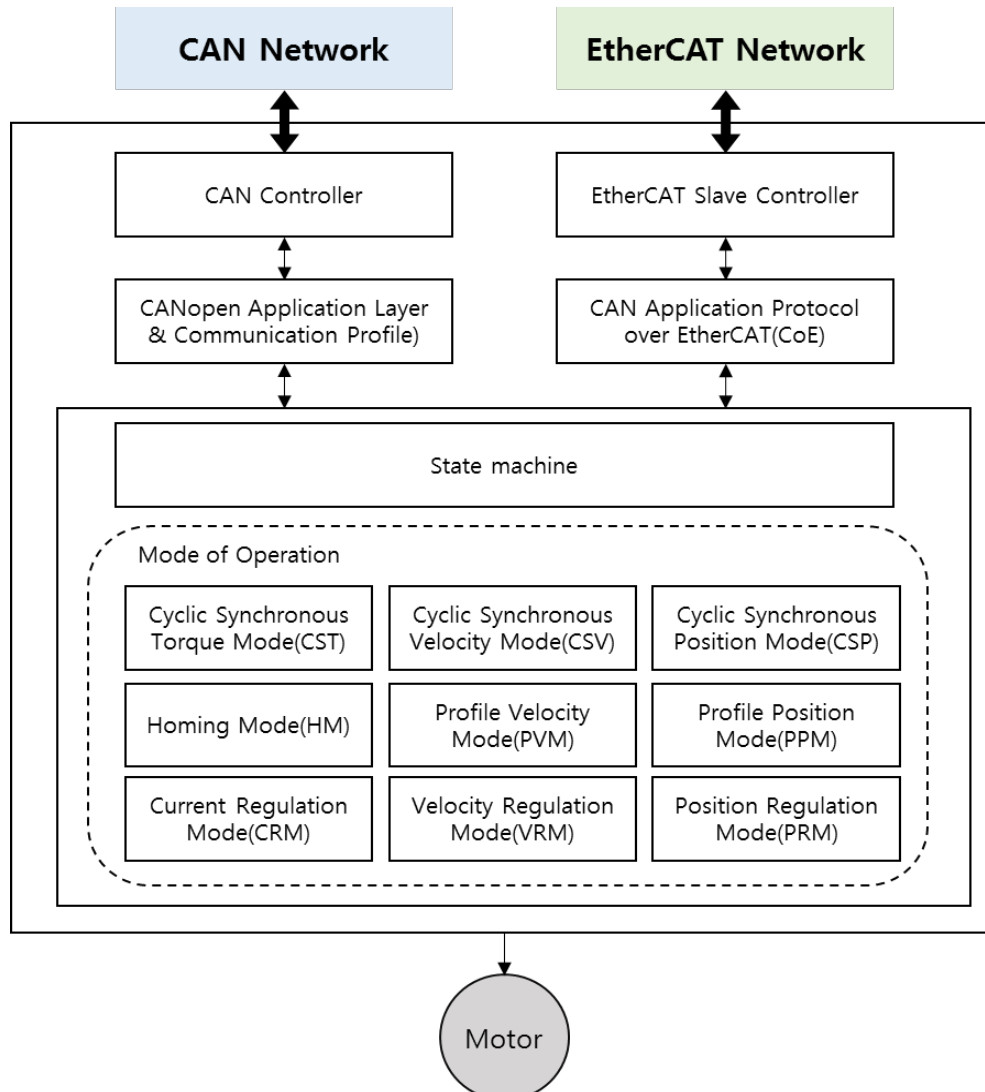
4. System Overview

4.1 Device Architecture

[TODO] Check and add content

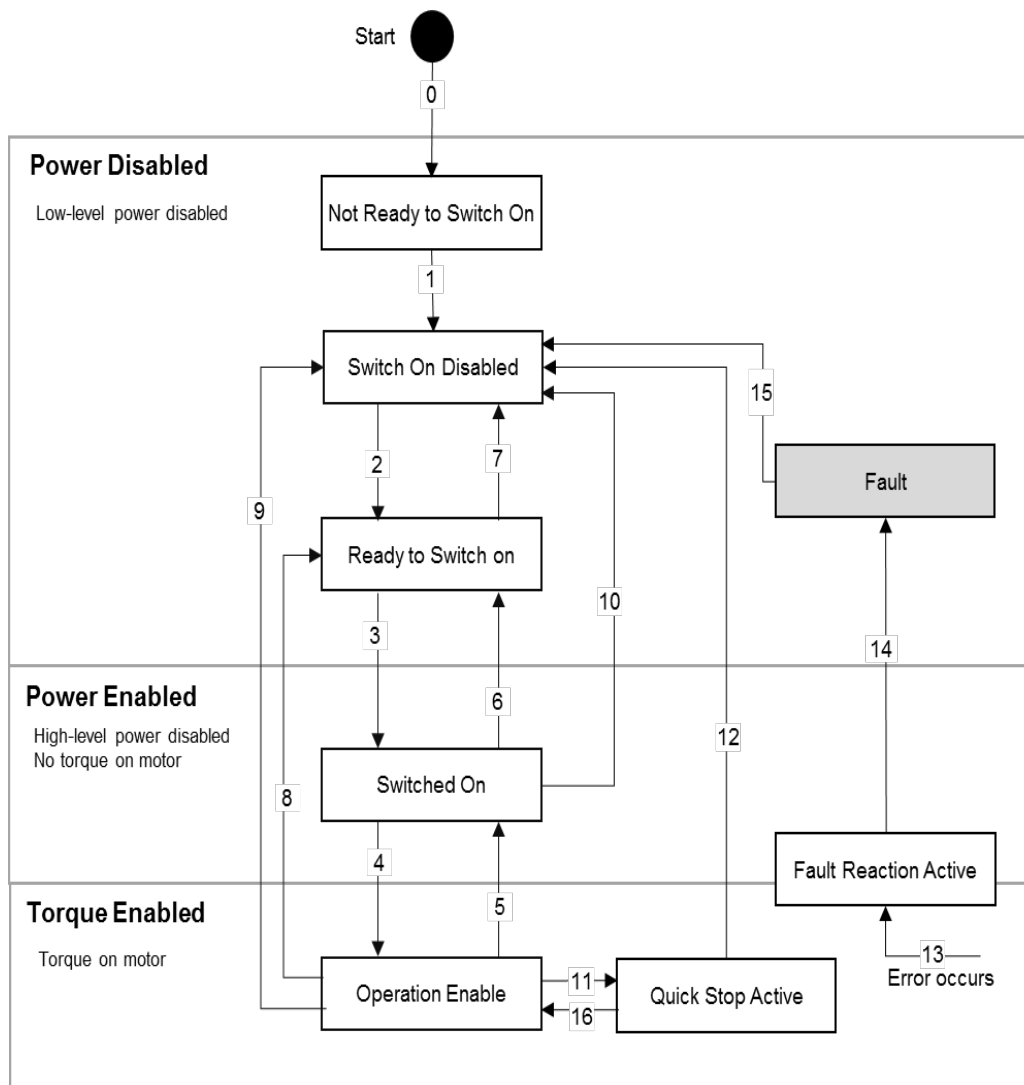
EtherCAT communication interface conforms to the following specifications.

- CiA 301 CANopen application layer and communication profile
- CiA 402 CANopen device profile for drives and motion control
- ETG.1000 EtherCAT Specification
- ETG.1020 EtherCAT Protocol Enhancements Specification
- ETG.2000 EtherCAT Slave Information (ESI) Specification



4.2 Device Control

State machine describes the drive status and the possible control sequences. The state indicates a special internal or external motion. The determination of acceptable command depends on the drive status. Such state may vary with the Controlword and internal events. The current status can be read by means of the Statusword. No new transition should be initiated until the previous state transition is completely finished and the state changes accordingly.



4.2.1 State of the Drive

The following list of Statusword bits indicates the current status of drive.

In the State Machine, the state can be determined by a combination of Statusword bits (0x6041) as shown below.

State	Statusword [binary]	Description
Not Ready to Switch On	xxxx xxxx x0xx 0000	Initialization state after control power ON Drive unit is disabled
Switch On Disabled	xxxx xxxx x1xx 0000	Drive initialization is completed No main power is available Drive unit is disabled
Ready to Switch On	xxxx xxxx x01x 0001	Main power is available Drive unit is disabled
Switched On	xxxx xxxx x01x 0011	Main power ON Current offset compensation is completed Drive unit is disabled
Operation Enable	xxxx xxxx x01x 0111	There is no error, and the drive unit is enabled Servo ON state with power being applied onto the motor
Quick Stop Active	xxxx xxxx x00x 0111	Quick stop is running Drive unit is enabled Motor is receiving power
Fault Reaction Active	xxxx xxxx x0xx 1111	Drive error occurs, and the relevant sequences are handled.
Fault	xxxx xxxx x0xx 1000	Drive error occurs Drive unit is disabled

4.2.2 State Transitions

State transition is triggered by the commands from the host that are transferred in the Controlword or via internal events. Once a command that triggers the state transition is received, this command is completely processed so as to achieve a new state before processing the next command.

Transition	Event	Action
0	Reset	Drive initialization
1	The drive has initialized successfully	Communication is activated
2	'Shutdown' command received	
3	'Switch On' command received	Current sensor initialization, Current offset calibration
4	'Enable Operation' command received	Drive unit is enabled (current control, if necessary, position or speed control)

5	'Disable Operation' command received	Drive is disabled as per the 'Disable Operation' option. Drive unit is disabled
6	'Shutdown' command received	Power OFF
7	'Quick Stop' or 'Disable Voltage' command received	
8	'Shutdown' command received	Drive is disabled as per the 'Shutdown' option. Drive unit and power is disabled
9	'Disable Voltage' command received	Drive is disabled as per the Disable option, Drive unit and power is disabled
10	'Quick Stop' or 'Disable Voltage' command received	
11	'Quick Stop' command received	Drive is disabled as per the Quick Stop option
12	'Disable Voltage' command received	Power and drive unit is disabled
13	A fault has occurred	Error sequence is initiated
14	The fault reaction is completed	Drive unit and power is disabled
15	'Fault Reset' command received	Error Reset unless there is an error
16	'Enable Operation' command received	Drive unit is enabled

[Device State Transition]


4.2.3 Device Control Commands

Drive control command is triggered by the following bit patterns in the Controlword.

Command	LowByte of Controlword [binary]	State transition
Shutdown	0xxx x110	2,6,8
Switch On	0xxx x111	3
Disable Voltage	0xxx xx0x	7,9,10,12
Quick Stop	0xxx x01x	7,10,11
Disable Operation	0xxx 0111	5
Enable Operation	0xxx 1111	4,16
Fault Reset	0xxx xxxx → 1xxx xxxx	14, 15

- **Device Control Command Triggers**

Bits 0 – 3 and 7 : device control command triggers

Command	Bits of the controlword					Transitions
	7	3	2	1	0	
	Fault Reset	Enable Operation	Quick Stop	Enable Voltage	Switch On	
Shutdown	0	``X	1	1	0	2, 6, 8
Switch ON	0	0	1	1	1	3*
Switch ON	0	1	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		X	X	X	X	15

- The bits marked with X are irrelevant.
- * the drive performs SWITCH_ON.
- ** the drive does nothing in this state and is treated the same as *.

5. Operating Mode

5.1 Operating Mode Selection Guide

Drive motions vary depending on the currently activated Mode of Operation.

With the Mode of operation (0x6060), the desired mode can be selected. The actual mode can be read in the Mode of Operation display.

5.2 Overview

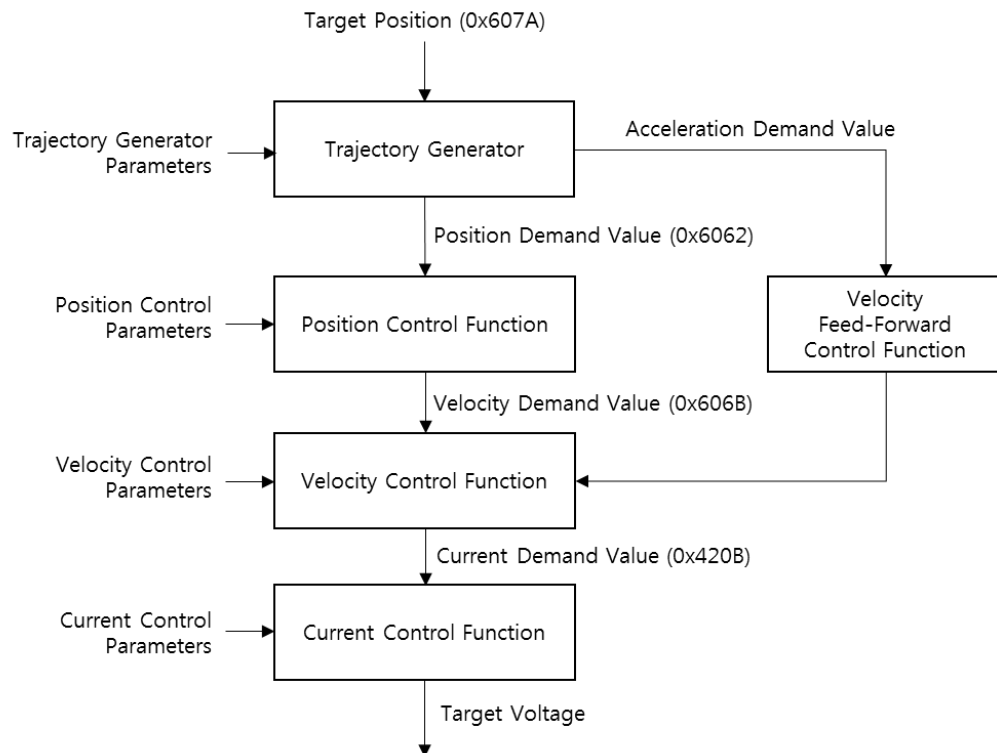
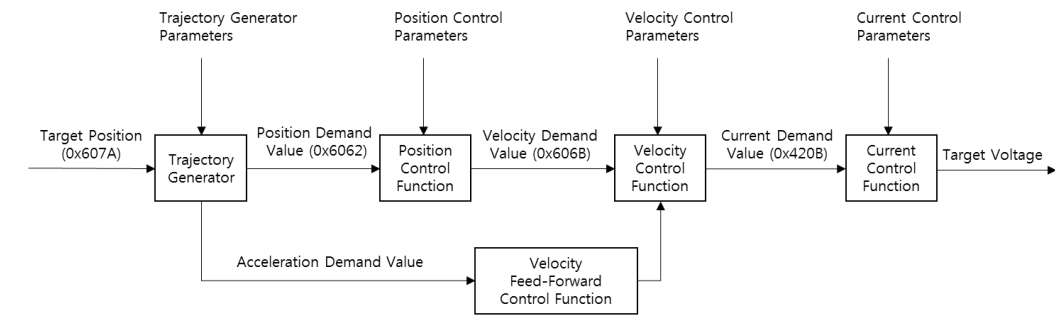
Drive supports the following operating modes.

Modes of Operation : 0x6060		
Value	Description	Note
10	Cyclic Synchronous Torque Mode(CST)	Target torque is provided to the drive unit cyclically in a synchronized manner, and the torque control is performed.
9	Cyclic Synchronous Velocity Mode(CSV)	Target velocity is provided to the drive unit cyclically in a synchronized manner, and the speed control and torque control are performed.
8	Cyclic Synchronous Position Mode(CSP)	Target position is provided to the drive unit cyclically in a synchronized manner, and the position control, speed control, and torque control are performed.
6	Homing Mode(HM)	Various methods of finding initial position (homing) are provided.
3	Profile Velocity Mode(PVM)	Drive speed is controlled without a special focus on the position. Output limitation and trajectory generation functions are provided.
.	Profile Position Mode(PPM)	Drive position is defined. In this mode, velocity, position and acceleration can be limited. With the Trajectory Generator, a profiled move can be performed.
-8	Position Regulation Mode(PRM)	Position demand values of a position controller can be set directly in the Position Mode.
-9	Velocity Regulation Mode(VRM)	Velocity demand values can be set directly in the Velocity Mode. This can be useful when the master position control loop is employed.
-10	Torque Regulation Mode(TRM)	Target Torque is used to perform controls in the Torque Mode.
-12	Current Regulation Mode(CRM)	In the Current Mode, only the current control loop and the speed limit are enabled. This mode is useful when the master position or speed control loop is employed.
-128	Motion Sequence Mode(MSM)	This mode sequentially performs the motions specified in the motion table that has been registered with the drive.

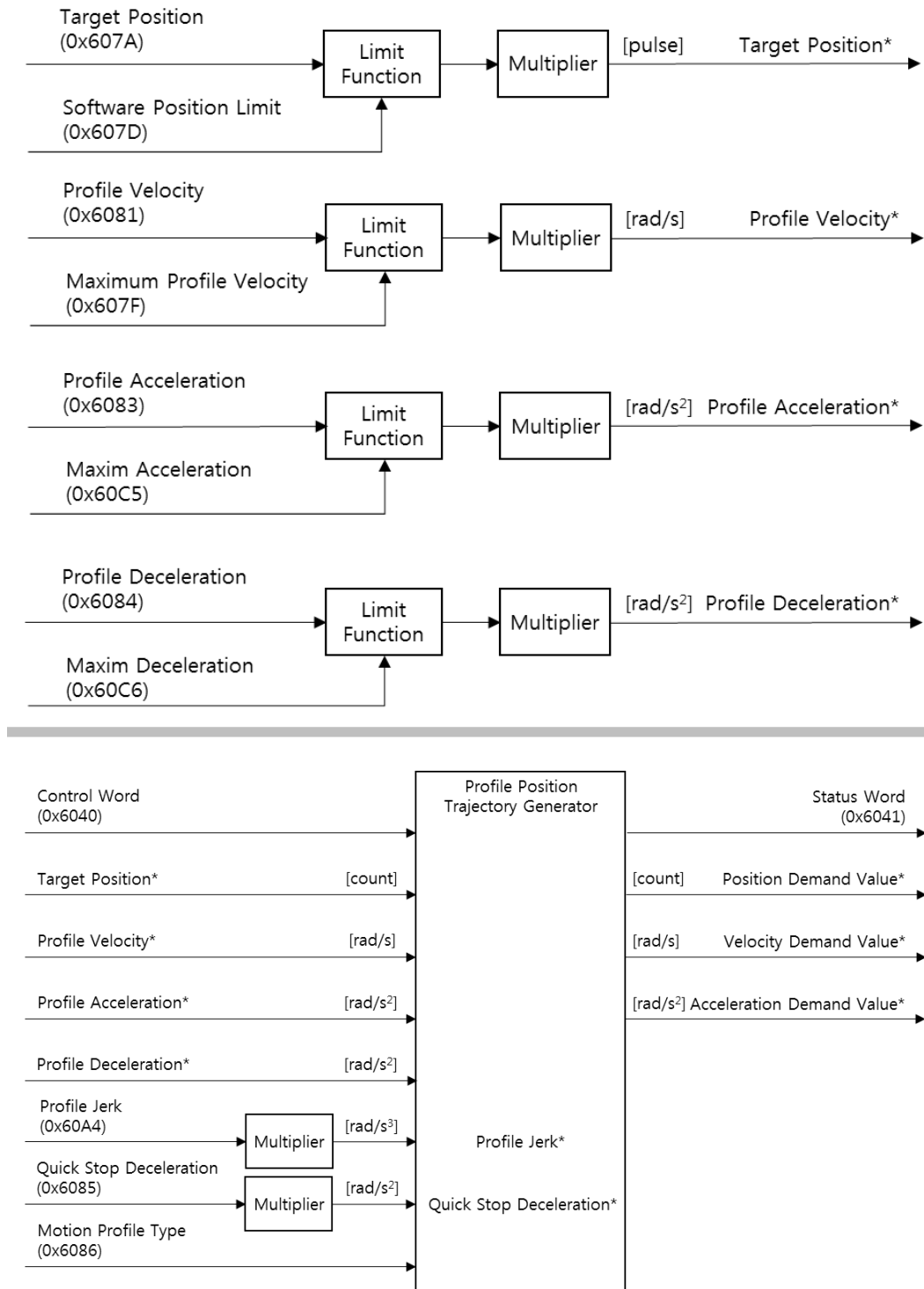
5.3 Profile Position Mode (PPM)

This chapter describes how to set the Point-To-Point (PTP) movement in a profiled position where the target position is applied to the trajectory generator. The Position Demand value is generated in the control loop. Input data of the trajectory generator include the profile velocity, acceleration, deceleration, jerk and profile types, and position limits. Parameters for trajectory generation are given on a per-user basis and are limited before being normalized to an internal unit.

The overall structure of the Profile Position Mode is shown as follows. The Target Position is applied to the trajectory generator, where the Position Demand Value for position control, the Velocity Demand Value and the Acceleration Demand Value for feed-forward compensation of the speed controller are generated.



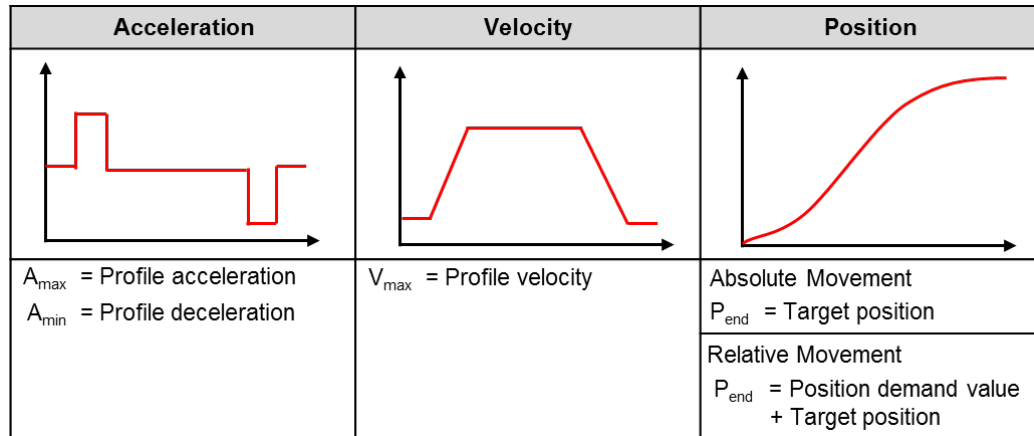
[Profile Position Mode - Overview]



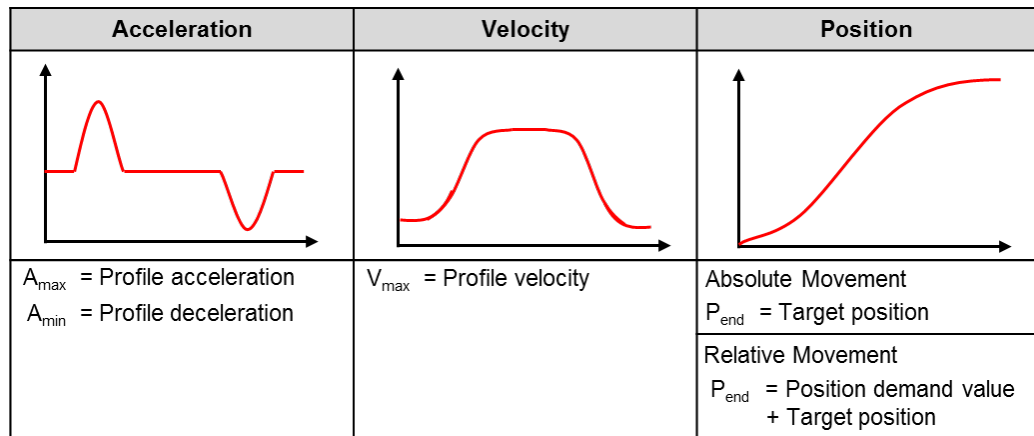
[Profile Position Mode – Block Diagram]

5.3.1 Profile Position Trajectory Generator

As shown below, the Trapezoidal Velocity Profile and the Sinusoidal Velocity Profile are generated by the Trajectory generator based on the motion profile option.



[Profile Position Trajectory – Trapezoidal Profile]



[Profile Position Trajectory – Sinusoidal Profile]

5.3.2 How to Use PPM

- Configuration Parameter

Parameter	Index	Description
Software position limit	0x607D	Includes "min position limit" and "max position limit" of sub-parameters. Defines absolute position limits for Position Demand Value and Position Actual Value. Every new Target Position is checked for these limits.
Max profile velocity	0x607F	Defines max permissible speed
Max motor speed	0x6080	Indicates max permissible motor speed. It serves as motor protection and is extracted from motor data sheet.
Quick stop deceleration	0x6085	Defines deceleration ramp in the Quick Stop state.
Max acceleration	0x60C5	Defines max permissible acceleration and deceleration.
Max deceleration	0x60C6	Defines max permissible deceleration.

- Commanding Parameters

Parameter	Index	Description
Controlword	0x6040	The mode is controlled by write access to the mode dependent bits in the Controlword.
Target position	0x607A	Indicates the position to which the drive should move by using motion control parameters such as velocity, acceleration and motion profile types. Interpreted as absolute or relative, depending on the "abs / rel " flag in the Controlword.
Profile velocity	0x6081	Indicates the velocity attained at the end of acceleration in the profile movement.
Profile acceleration	0x6083	Defines the motion profile acceleration.
Profile deceleration	0x6084	Defines the motion profile deceleration.
Motion profile type	0x6086	Selects the motion profile type used to perform a profile movement. 0 = Trapezoidal (trapezoidal profile) 1 = sinusoidal (sinusoidal profile)

- Controlword (Profile Position Mode – Specific Bits)

Bit 15..9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3..0
	Halt		Abs/Rel	Change set immediately	New setpoint	

[Profile Position Mode – Controlword]

Name	Value	Description
New setpoint	0	Does not assume Target position.
	0→1	Assumes Target position.
Change set immediately	0	Starts the next positioning after finishing the actual positioning. Actual positioning is deemed complete as soon as Position Demand Value reaches Target position.
	1	Interrupts actual positioning and starts next positioning.
Abs/Rel	0	Target position is an absolute value.
	1	Target position is a relative value.
Halt	0	Executes or continues positioning
	1	Stops with Profile deceleration.

[Profile Position Mode – Controlword Bits]

- Output Parameter

Parameter	Index	Description
Statusword	0x6041	Mode status can be monitored using the Statusword bits.
Position demand value	0x6062	Indicates the output position of Trajectory Generator, which can be used as input to Position controller.

[Profile Position Mode – Output Parameters]

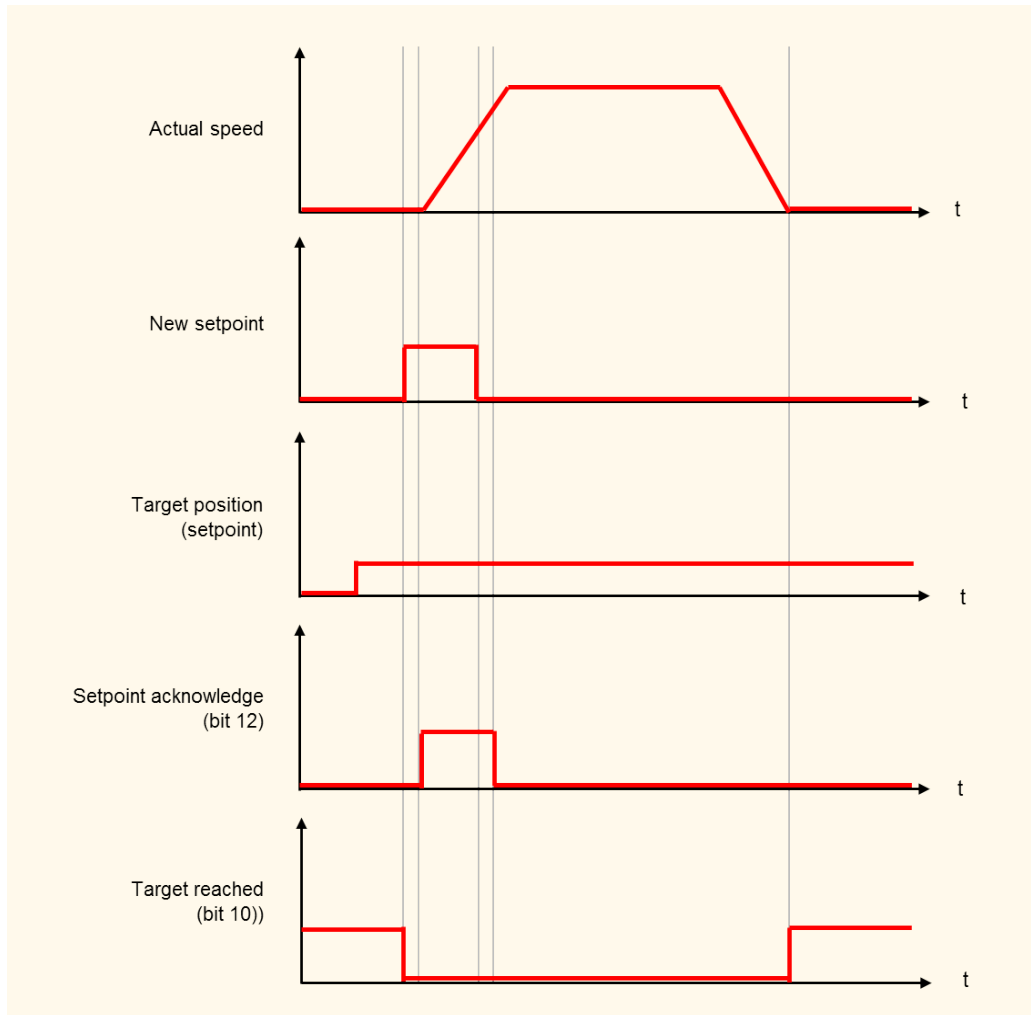
- Statusword (Profile Position Mode – Specific Bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9..0
	Following error	Setpoint acknowledge		Target reached	

[Profile Position Mode – Statusword]

Name	Value	Description
Target reached	0	Halt=0: Target position not reached Halt=1: decelerate
	1	Halt=0: Target position reached Halt=1: velocity is 0
Setpoint acknowledge	0	Positioning to the previous setpoints. New setpoints are acknowledgeable.
	1	Previous setpoints have been applied, and no additional setpoints are acknowledgeable.
Following error	0	Not following error
	1	following error

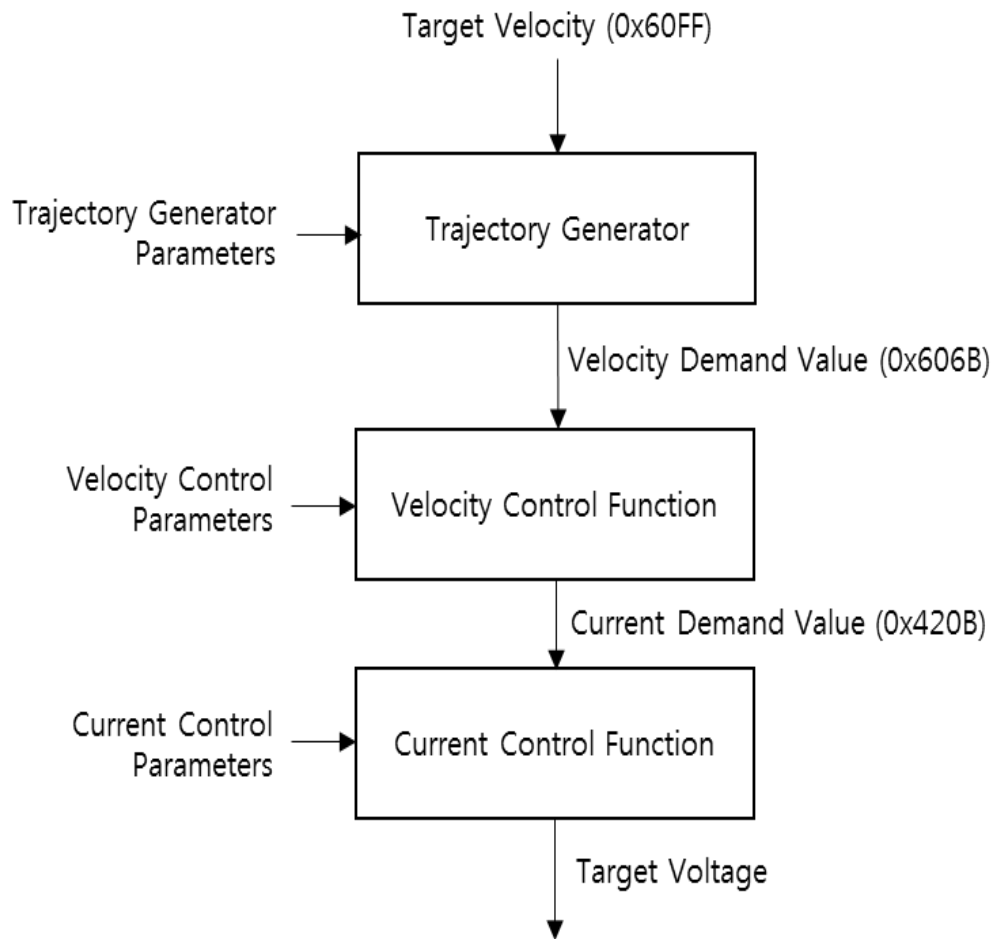
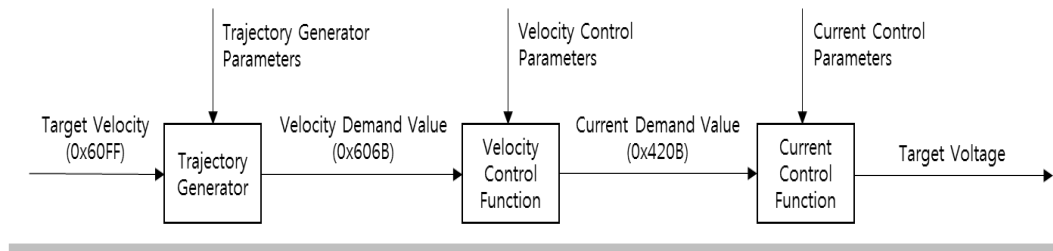
[Profile Position Mode – Statusword Bits]



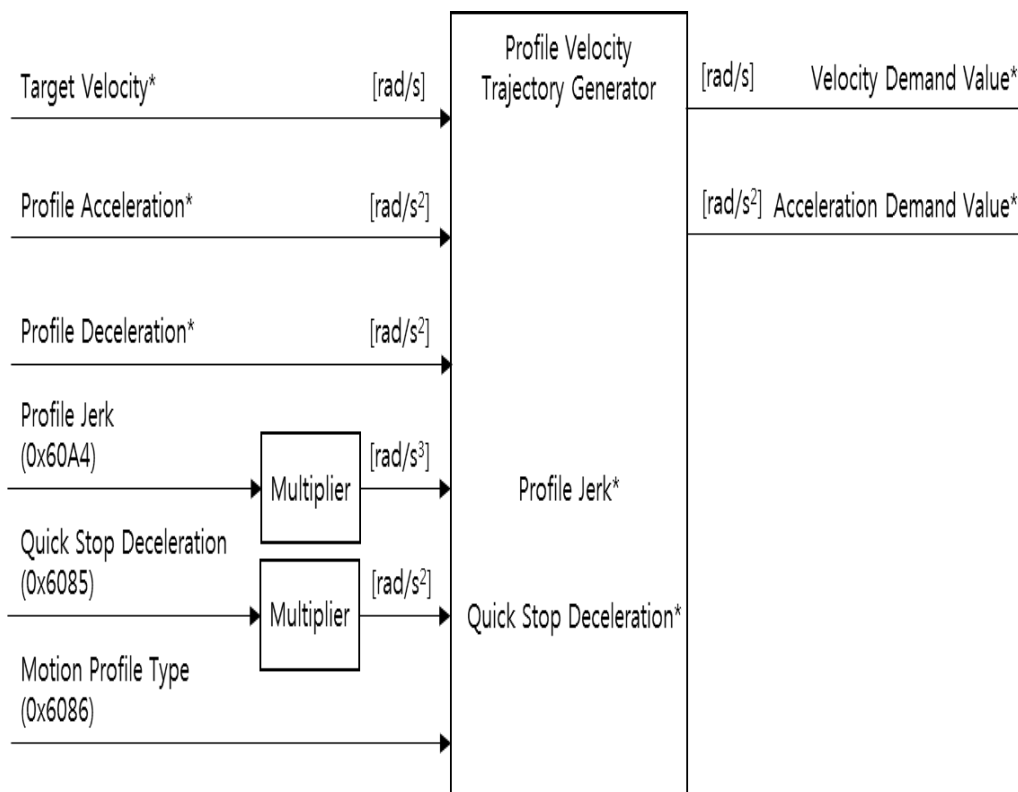
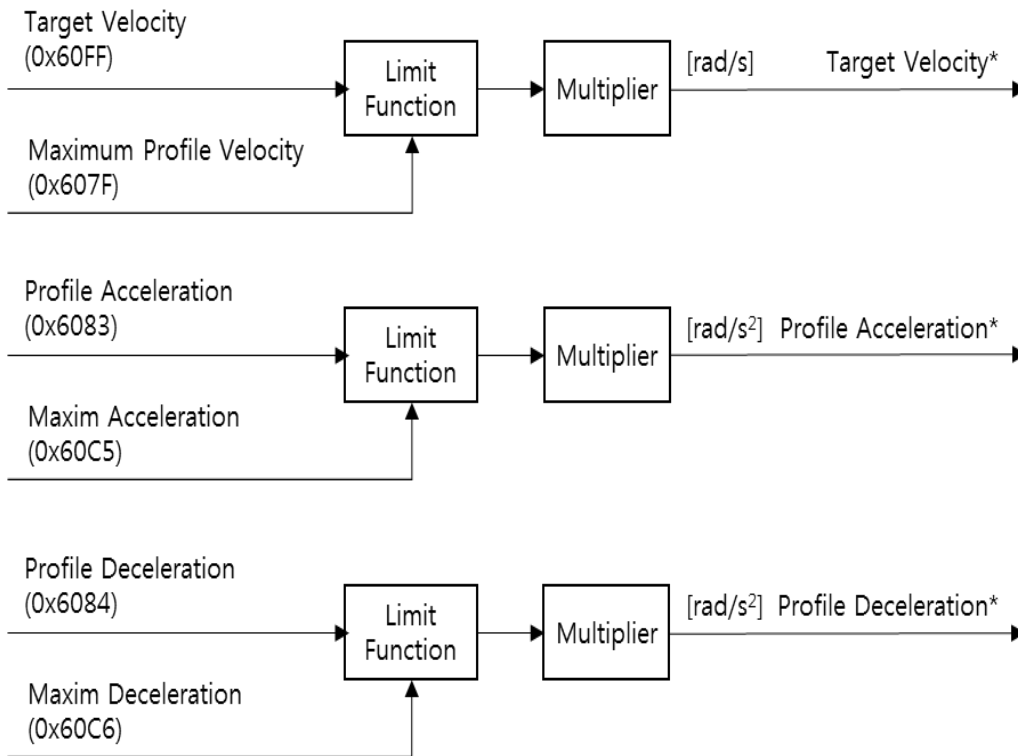
[Profile Position Mode – Setpoint Example]

5.4 Profile Velocity Mode (PVM)

Profile Velocity Mode includes the velocity trajectory generator and the velocity control function. Unlike the CSV Mode that receives the target velocity, which is renewed after each PDO update cycle, from the host controller, the Profile Velocity Mode is a speed control mode that generates a velocity profile up to the target velocity (0x60FF) internally by means of the profile acceleration (0x6083) and profile deceleration (0x6084). Here, the max speed is limited to the profile max speed (0x607F). The block diagram of Profile Velocity Mode is as follows.



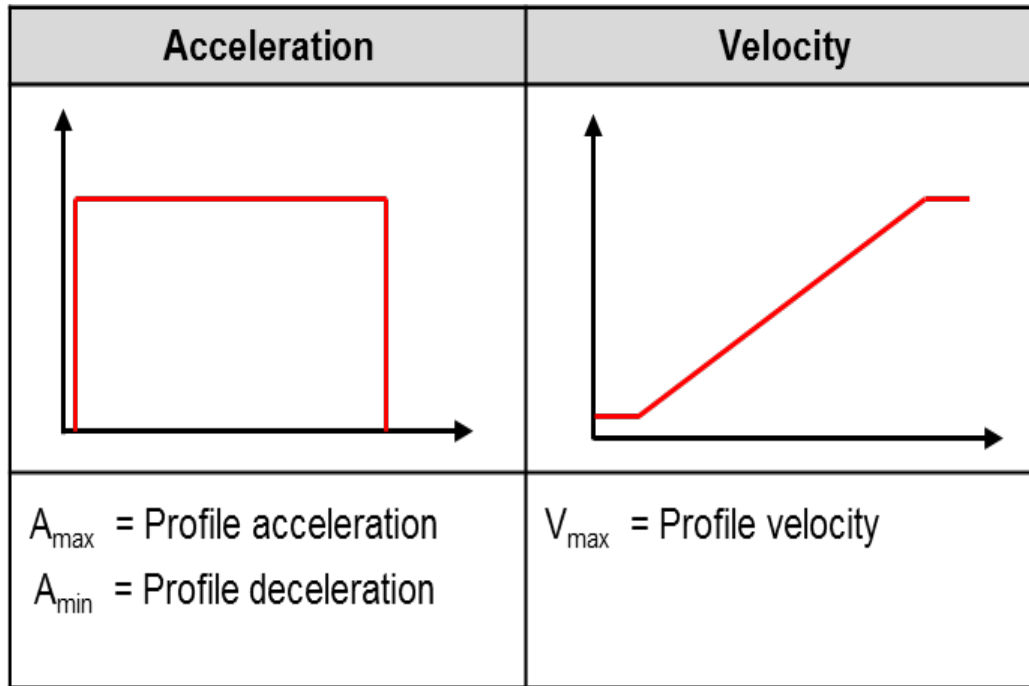
[Profile Velocity Mode- Overview]



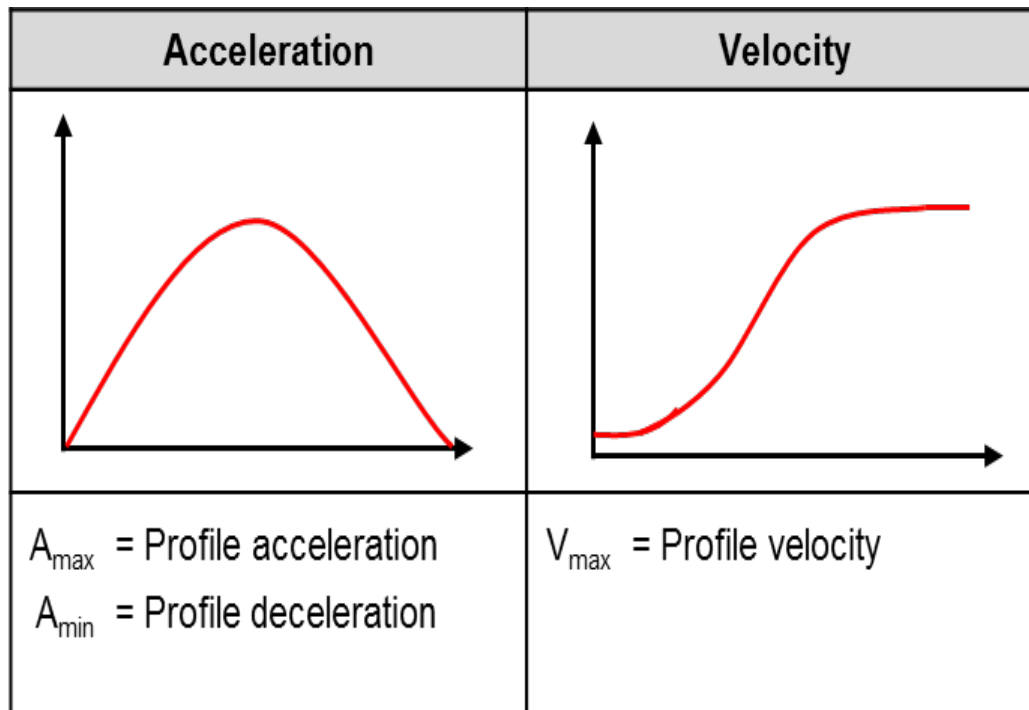
[Profile Velocity Mode – Block Diagram]

5.4.1 Profile Velocity Trajectory Generator

As shown below, the Trapezoidal Velocity Profile and the Sinusoidal Velocity Profile are generated by the Trajectory generator based on the motion profile option.



[Profile Velocity Trajectory – Trapezoidal profile]



[Profile Velocity Trajectory – Sinusoidal profile]

5.4.2 How to Use PVM

- Configuration Parameter

Parameter	Index	Description
Software position limit	0x607D	Includes 'min position limit' and 'max position limit' of sub-parameters. Defines absolute position limit of position demand value and position actual value. Every new target position is checked for these limits
Max profile velocity	0x607F	Defines max permissible speed
Max motor speed	0x6080	Indicates max permissible motor speed. It serves as motor protection and can be extracted from motor data sheet.
Quick stop deceleration	0x6085	Defines deceleration ramp in the Quick Stop state.
Max acceleration	0x60C5	Defines max permissible acceleration.
Max deceleration	0x60C6	Defines max permissible deceleration.

[Profile Velocity Mode – Configuration Parameters]

- Commanding Parameters

Parameter	Index	Description
Controlword	0x6040	The mode is controlled by write access to the mode dependent bits in the Controlword. No new target velocity is assumed before the Controlword is written.
Target Velocity	0x60FF	Velocity that the drive should reach
Profile acceleration	0x6083	Defines acceleration ramp during a movement
Profile deceleration	0x6084	Defines deceleration ramp during a movement
Motion profile type	0x6086	Selects a motion profile type used for a movement. 0 = Trapezoidal (trapezoidal profile) 1 = sinusoidal (sinusoidal profile)

- Controlword (Profile Velocity Mode – Specific Bits)

Bit 15..9	Bit 8	Bit 7	Bit 6..4	Bit 3..0
	Halt		reserved	

[Profile Velocity Mode – Controlword]

Name	Value	Description
Halt	0	Executes or continues the motion
	1	Stops the motion

[Profile Velocity Mode – Controlword Bits]

- **Output Parameter**

Parameter	Index	Description
Statusword	0x6041	Mode status can be monitored with the Statusword bits.
Velocity demand value	0x606B	Output of velocity trajectory generator. Used as input for speed control function

[Profile Velocity Mode – Output Parameters]

- **Statusword (profile Velocity Mode – Specific Bits)**

Bit 15, 14	Bit 13	Bit 12	Bit 11(*2)	Bit 10	Bit 9..0
	Not used	Speed	Speed is Limited	Target reached	

[Profile Velocity Mode – Statusword]

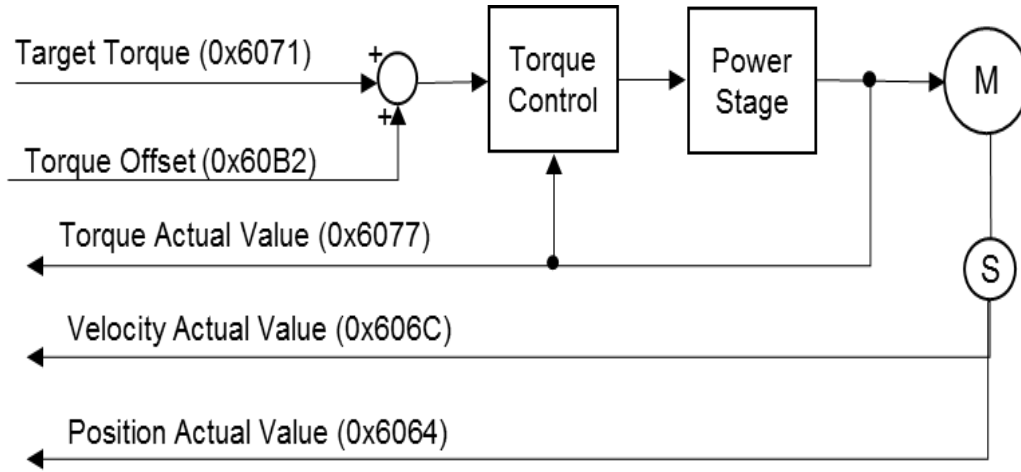
Name	Value	Description
Target reached	0	Halt=0: Target speed not reached Halt=1: decelerate
	1	Halt=0: Target speed reached Halt=1: speed is 0
Speed	0	Speed ≠ 0
	1	Speed = 0
Speed is limited	0	Speed is not limited
	1	Speed has reached its limit (Max Profile velocity)

[Profile Velocity Mode – Statusword Bits]

5.5 Cyclic Synchronous Torque Mode (CST)

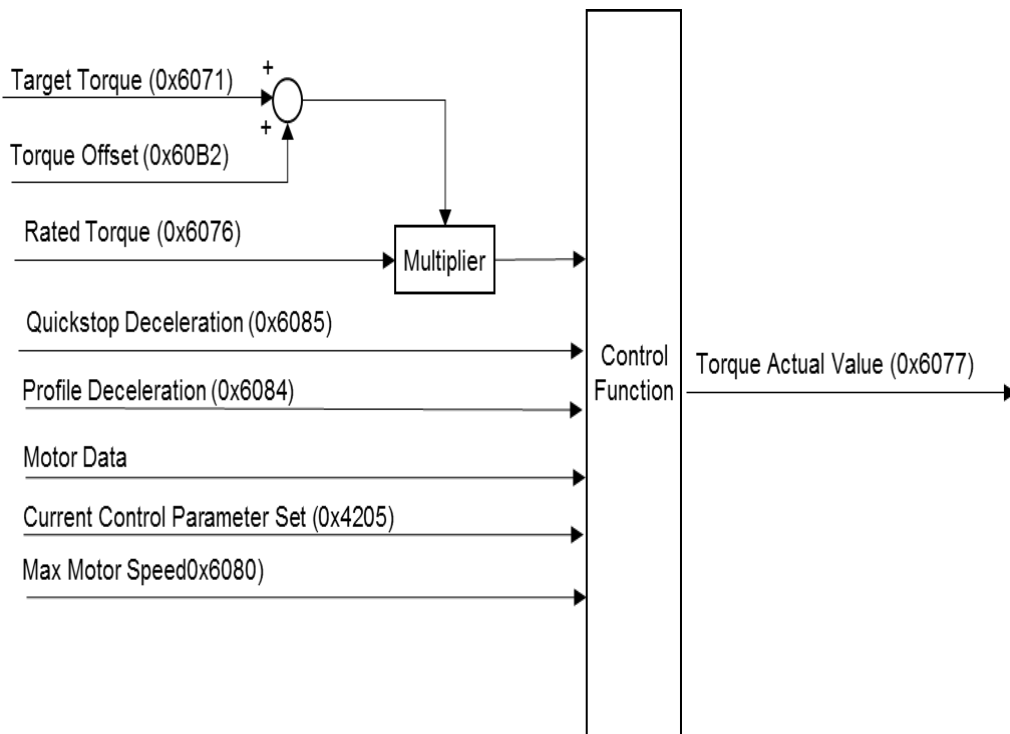
CST(Cyclic Synchronous Torque) Mode controls the torque by receiving the Target Torque (0x6071), which is renewed after each PDO update cycle, from the host controller. In this mode, the Torque Offset (0x60B2) for Feed-Forward compensation can be calculated by the host controller and forwarded to the drive.

In the CST mode, the trajectory generator is located in the control device (not in the drive unit). The mode cyclically provides the drive with the target torque in a synchronized manner in order to perform a torque control. The block diagram of the CST mode is as follows.



[Cyclic Synchronous Torque Mode - Overview]

Cyclic Synchronous Torque (CST) is based on the current control function. Input parameters include the target torque and the torque offset (optional). Motor input data is used to define the speed and current value limits. Actual values of position, speed, and torque are used as output parameters for the control device.



[Cyclic Synchronous Torque Mode – Block Diagram]

5.5.1 How to Use CST

- **Configuration Parameter**

Parameter	Index	Description
Motor Rated Current	0x6075	Max continuous permissible motor current
Motor torque constant	0x4003	Torque constant for motor
Max motor speed	0x6080	Max permissible moto speed. It serves as motor protection and is taken from motor data sheet (operates only during PDO communication).
Current control parameter set	0x4205	Current control gain setting
Quick stop deceleration	0x6085	Defines deceleration in the state of Quick stop
Profile deceleration	0x6084	Defines motion profile deceleration
Motor rated torque	0x6076	Retains all relative torque object data.
Software position limit	0x607D	Used to set the absolute position limits. A software position limit error is generated if target position or actual position exceeds the limit.

[Cyclic Synchronous Torque Mode – Configuration Parameters]

- **Commanding Parameters**

Parameter	Index	Description
Target torque	0x6071	Input value for torque controller (linear interpolation between PDO values)
Torque offset	0x60B2	Optional torque that can be added to the target toque value

[Cyclic Synchronous Torque Mode – Commanding Parameters]

- **Controlword**

CST mode does not use the mode-specific control bit.

- **Output Parameter**

Parameter	Index	Description
Torque actual value	0x6077	Actual motor torque value
Velocity actual value	0x606C	Actual velocity value
Position actual value	0x6064	Actual position is absolute position against zero position of the system

[Cyclic Synchronous Torque Mode – Output Parameters]

- Statusword (Cyclic Synchronous Torque Mode – Specific Bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9..0
	Reserved	Drive follows command value		Reserved	

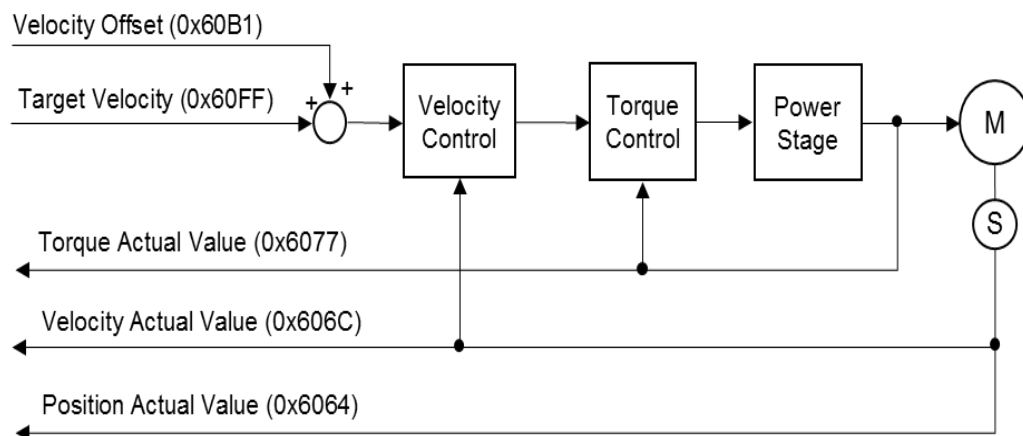
[Cyclic Synchronous Torque Mode – Statusword]

Name	Value	Description
Drive follows command value	0	Drive does not follow target value.
	1	Drive unit is in the operating state. It activates and tracks the target values and set points of the control device.

[Cyclic Synchronous Torque Mode – Statusword Bits]

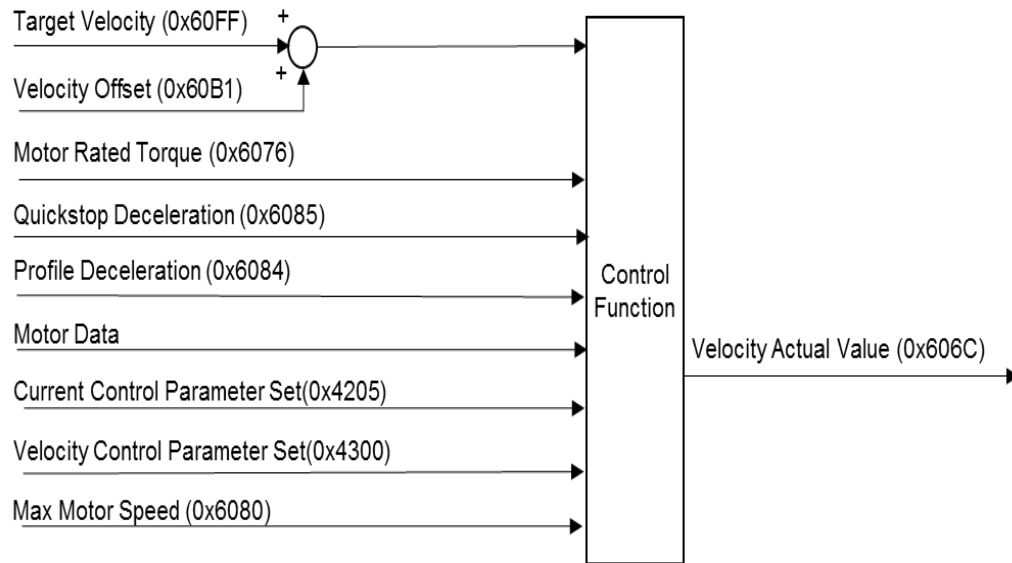
5.6 Cyclic Synchronous Velocity Mode (CSV)

CSV (Cyclic Synchronous Velocity) mode controls the speed by receiving the Target Velocity (0x60FF), which is renewed after each PDO update cycle, from the host controller. By providing a cyclic synchronous target velocity, this mode allows the drive device to perform speed control and torque control on the drive. The block diagram of the CSV mode is as follows.



[Cyclic Synchronous Velocity Mode – Overview]

CSV mode is based on the speed control function. Input parameter includes the target velocity. Optionally, additional velocity value can be provided by the control system to allow for a secondary source designed to control the velocity feed-forward compensation. The linear interpolation, based on interpolation time cycles, is executed between two velocity values. Such interpolation is valid only in the PDO communication. The torque offset is not taken into account as much. Motor input data are used to define the velocity and current value limits. The actual values of position, velocity, and torque are used as output parameters for the control device.



[Cyclic Synchronous Velocity Mode – Block Diagram]

5.6.1 How to Use CSV

- Configuration Parameter

Parameter	Index	Description
Motor Rated Current	0x6075	Max continuous permissible motor current
Motor torque constant	0x4003	Torque constant for motor
Current control parameter set	0x4205	Current control gain setting
Velocity control parameter set	0x4300	Velocity controller setting
Quick stop deceleration	0x6085	Defines deceleration in the state of Quick stop
Profile deceleration	0x6084	Defines deceleration ramp
Software position limit	0x607D	Used to set the absolute position limit. A software position limit error is generated if target position or actual position exceeds the limit.
Motor rated torque	0x6076	Retains all relative torque object data.
Max motor speed	0x6080	Indicates max permissible motor speed. It serves as motor protection and is taken from motor data sheet. (operates only in the PDO communication)

- **Commanding Parameters**

Parameter	Index	Description
Target Velocity	0x60FF	Input value for speed controller (linear interpolation between PDO values)
Velocity offset	0x60B1	(Operational) velocity feed-forward input

[Cyclic Synchronous Velocity Mode – Commanding Parameters]

- **Controlword**

CSV mode does not use the mode-specific control bits.

- **Output Parameter**

Parameter	Index	Description
Torque actual value	0x6077	Actual value of motor torque
Velocity actual value	0x606C	Actual value of velocity
Position actual value	0x6064	Actual position is the absolute position against zero position of the system

[Cyclic Synchronous Velocity Mode – Output Parameters]

- **Statusword (Cyclic Synchronous Velocity Mode – Specific Bits)**

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9..0
	Reserved	Drive follows command value		Reserved	

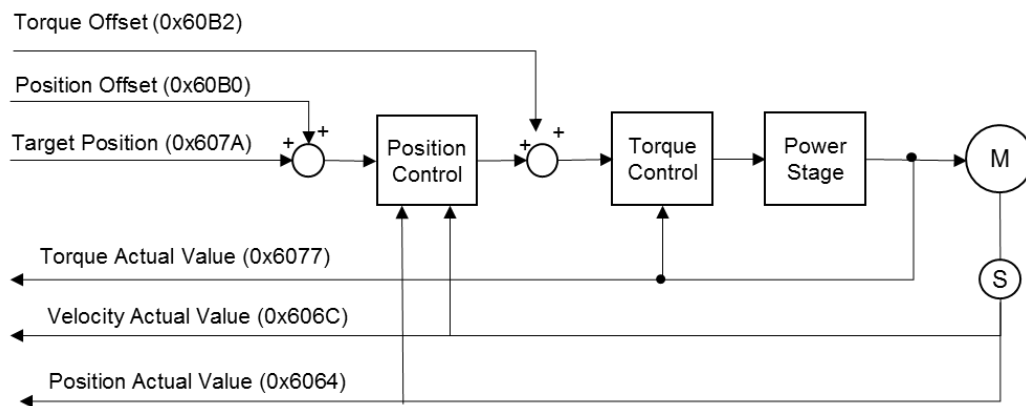
[Cyclic Synchronous Velocity Mode – Status]

Name	Value	Description
Drive follows command value	0	Drive does not follow target value.
	1	Drive unit is in the operating state. It activates and tracks the target values and set points of the control device.

[Cyclic Synchronous Velocity Mode – Status Bits]

5.7 Cyclic Synchronous Position Mode (CSP)

CSP (Cyclic Synchronous Position) mode performs a position control by receiving the Target Position (0x607A), renewed after each PDO update cycle, from the host controller. In the CSP mode, the trajectory generator is located in the control device (not in the drive unit). By providing a cyclic synchronous target position, this mode allows the drive unit to control the position, speed, and torque. The block diagram of the CSV mode is as follows.



[Cyclic Synchronous Position Mode – Overview]

CSP mode is based on the position control function. Input parameters include the target position and (optionally) the position offset. The linear, time-cycled interpolation is executed between two position values. Such interpolation is valid only in the PDO communication. The velocity offset is not factored in this mode.

In addition, optional torque offset is used for the feed-forward control. The motor data entered is used to define the current value (torque) limits. Other functions specified in this mode include the software position limit (used to set limits on the values to avoid any unintended positions) and the max motor speed and max gear input speed (limit setting and monitoring function).

5.7.1 How to Use CSP

- Configuration Parameter

Parameter	Index	Description
Motor Rated Current	0x6075	Max continuous permissible motor current
Motor torque constant	0x4003	Torque constant of motor
Current control parameter set	0x4205	Current control gain setting
Position control parameter set	0x4400	Position controller setting
Quick stop deceleration	0x6085	Defines deceleration in the state of Quick stop
Profile deceleration	0x6084	Defines deceleration ramp
Following error window	0x6065	Indicates max permissible difference of position demand value and position actual value. If exceeded, the Following Error occurs.
Software position limit	0x607D	Used to set absolute position limits. If the target position or actual position exceeds the limit, a Software Position Limit error is generated.
Motor rated torque	0x6076	Retains all relative torque object data.
Max motor speed	0x6080	Indicates max permissible motor speed. It serves as motor protection and is taken from motor data sheet (operates only in the PDO communication).

[Cyclic Synchronous Position Mode – Configuration Parameters]

- Commanding Parameter

Parameter	Index	Description
Target Position	0x607A	Position input value of position controller (linear interpolation between PDO values)
Position offset	0x60B0	Optional position value that can be added to the target position (linear interpolation between PDO values)
Torque offset	0x60B2	Operational torque feed-forward input

[Cyclic Synchronous Position Mode – Commanding Parameters]

- Controlword

CSP mode does not use the mode-specific control bits.

- **Output parameter**

Parameter	Index	Description
Torque actual value	0x6077	Actual value of motor torque
Velocity actual value	0x606C	Actual value of velocity
Position actual value	0x6064	Actual position is the absolute position against zero position of the system

[Cyclic Synchronous Position Mode – Output Parameters]

- **Statusword (Cyclic Synchronous Position Mode – Specific Bits)**

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9..0
	Following error	Drive follows command value		Reserved	

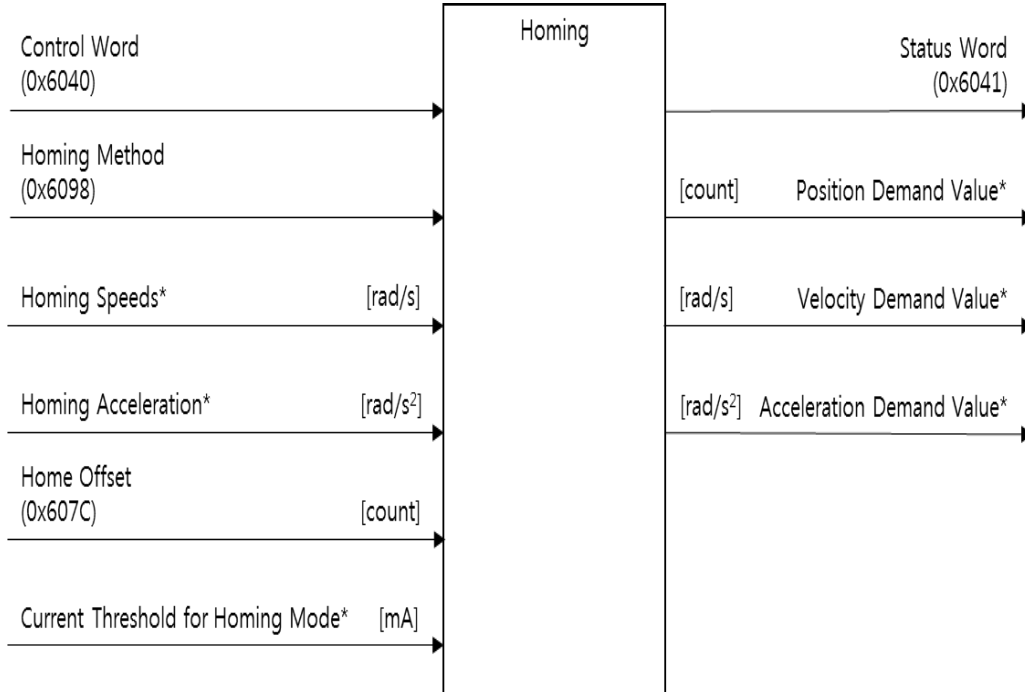
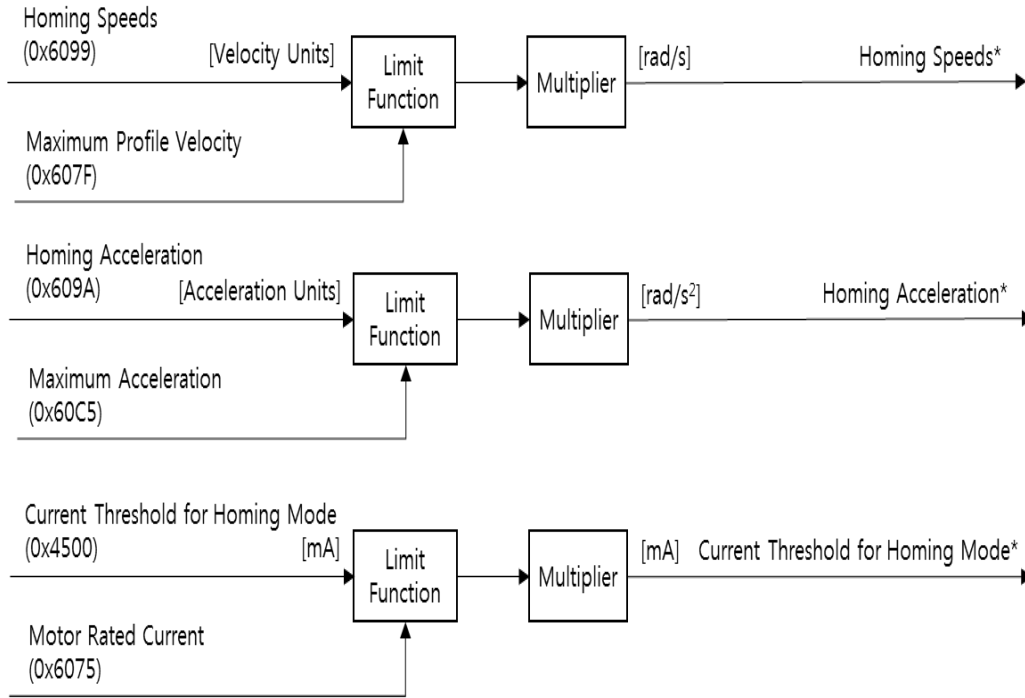
[Cyclic Synchronous Position Mode – Statusword]

Name	Value	Description
Drive follows command value	0	Drive unit does not follow the target value.
	1	Drive unit is in the operating state. It activates and tracks the target values and setpoints of the control device.
Following error	0	No Following error
	1	The difference between position demand value and actual position value exceeds max Following window

[Cyclic Synchronous Position Mode – Statusword Bits]

5.8 homing Mode (HM)

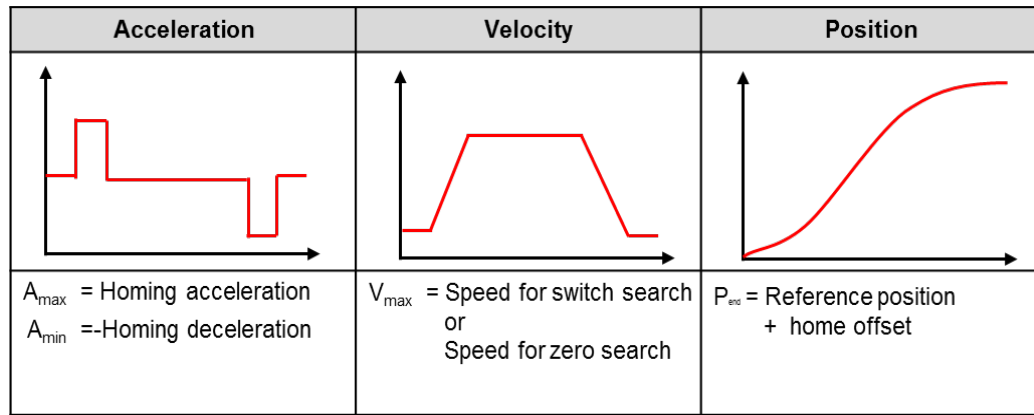
Homing Mode describes the details of how the drive unit finds home position (also called origin or initial position). There are various ways to achieve this goal, including the method employing the limit switches at both ends of travel. Some homing methods use the index (zero) pulse from an incremental encoder.



[Homing Mode – Block Diagram]

5.8.1 Homing Trajectory Generator

Trajectory generator supports the following motion profiles. Motions vary depending on the mode, and the end position is calculated internally.



[Homing Trajectory – Trapezoidal Profile]

5.8.2 How to Use HM

- Configuration Parameter

Parameter	Index	Description
Motion Profile type	0x6086	Selects the type of motion profile used for profile movement. 0 = Trapezoidal (trapezoidal profile)

[Homing Mode – Configuration Parameters]

- Commanding Parameter

Parameter	Index	Description
Controlword	0x6040	The mode is controlled by write access for the mode dependent bits in the Controlword.
Homing Method	0x6098	Defines the types of homing process.
Homing Speed	0x6099	Sets two types of speed used for the homing process (Switch Search Velocity and Zero Search Velocity). In a normal cycle, higher speed is used to search for a home switch. Lower speed, the offset movement, is used to search for an index pulse.
Homing acceleration	0x609A	Specifies the acceleration during the homing process.
Homing offset	0x607D	Indicates the distance from the detected position at the end of homing sequence
Current Threshold for homing mode	0x4500	Indicates the threshold current for the homing method using current index

[Homing Mode – Commanding Parameters]

- Controlword (Homing Mode – Specific Bits)

Bit 15..9	Bit 8	Bit 7	Bit 6,5	Bit 4	Bit 3..0
	Halt		Reserved	Homing operation start	

[Homing Mode – Controlword]

Name	Value	Description
Homing operation start	0	Do not start homing
	0→1	Start or continue homing
Half	0	Execute Bit 4 command
	1	Stop → Homing acceleration

[Homing Mode – Controlword Bits]

- Output Parameter

Parameter	Index	Description
Statusword	0x6041	The mode status can be monitored with the Statusword bits

[Homing Mode – Output parameters]

- Statusword (Homing Mode – Specific Bits)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9..0
Position Referenced to Home position		Homing error	Homing attained		Target reached	

[Homing Mode – Statusword]

Name	Value	Description
Bit 15 Position referenced to home position	0	No reference position for home position is found. (e.g. : homing not completed yet or position overflow)
	1	Homing has been attained, and reference position for home position is found.

[Homing Mode – Statusword Bit 15]

Bit 13 Homing error	Bit 12 Homing attained	Bit 10 Target reached	Description
0	0	0	Homing is in progress.
0	0	1	Homing process has been interrupted or not started.
0	1	X	Homing process has been successfully completed.
1	0	X	Homing error has occurred

[Homing Mode – Statusword Bits 10, 12, and 13]

5.8.3 Homing Method

This drive provides homing function on its own as shown below.

The following figure illustrates the relationship between input and output parameters for the homing mode.

Users can set the speed, acceleration, offset and homing method.

Value	Description
37	Actual Position
27	Home Switch Negative Speed
23	Home Switch Positive Speed
18	Positive Limit Switch
17	Negative Limit Switch
-3	Current Threshold Positive Speed
-4	Current Threshold Negative Speed

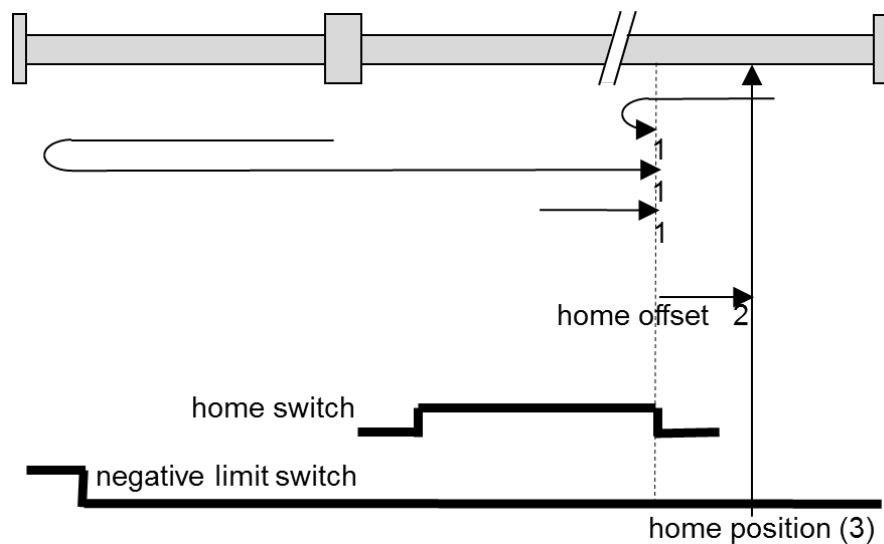
5.8.3.1 Method 37 : Actual Position

In this method, the current position turns into the home position. This method should only be applied in the Disabled state.

5.8.3.2 Method 27 : Home Switch Negative Speed

This method uses the home switches, and some are activated only when searching. As a result, the switch is activated instantaneously when the axis passes the switch. The initial direction of movement is leftward (negative position), except if the home switch is already activated at the start of motion.

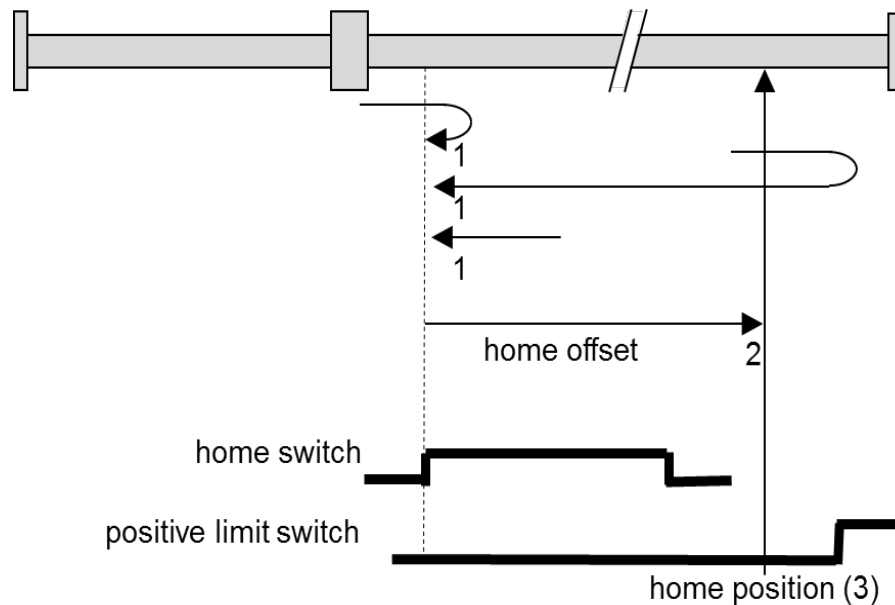
- A) Move to positive edge of Limit Switch
- B) Navigate the falling edge of Home Switch (1)
- C) Move by the Home Offset (2)
- D) This point serves as a reference for all subsequent movements and is set to Home Position. (3)



5.8.3.3 Method 23 : Home Switch Positive Speed

This method uses the home switch, and some are activated only when searching. As a result, the switch is activated instantaneously when the axis passes the switch. The initial direction of movement is rightward (positive position), except if the home switch is already activated at the start of motion.

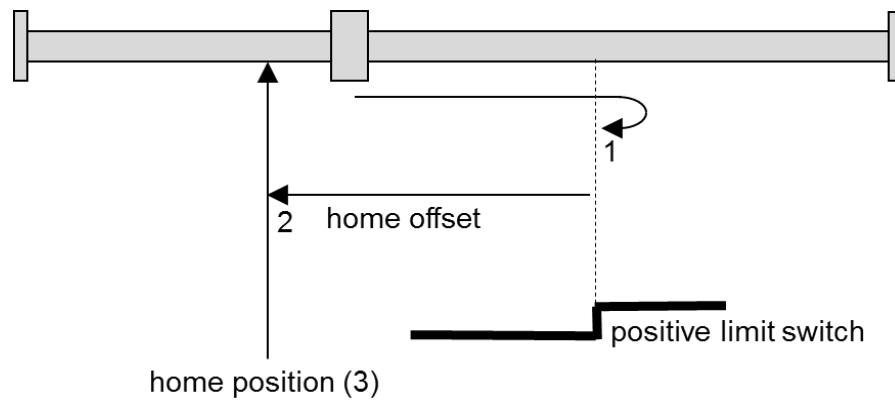
- A) Move to positive edge of Limit Switch
- B) Navigate the falling edge of Home Switch (1)
- C) Move by the Home Offset (2)
- D) This point serves as a reference for all subsequent movements and is set to Home Position. (3)



5.8.3.4 Method 18 : Positive Limit Switch

The initial position of movement is positive (rightward) if positive limit switch is inactive (here, low).

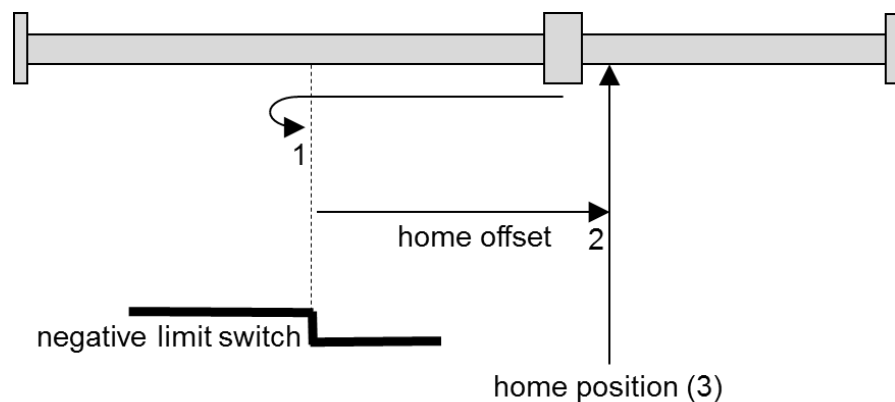
- A) Move to positive edge of Limit Switch (1)
- B) Navigate the falling edge of Positive Limit Switch and move by the Home Offset (2)
- C) This point serves as a reference for all subsequent movements and is set to Home Position. (3)



5.8.3.5 Method 17 : Negative Limit Switch

The initial direction of movement has negative value (leftward) if negative limit switch is inactive (here, low).

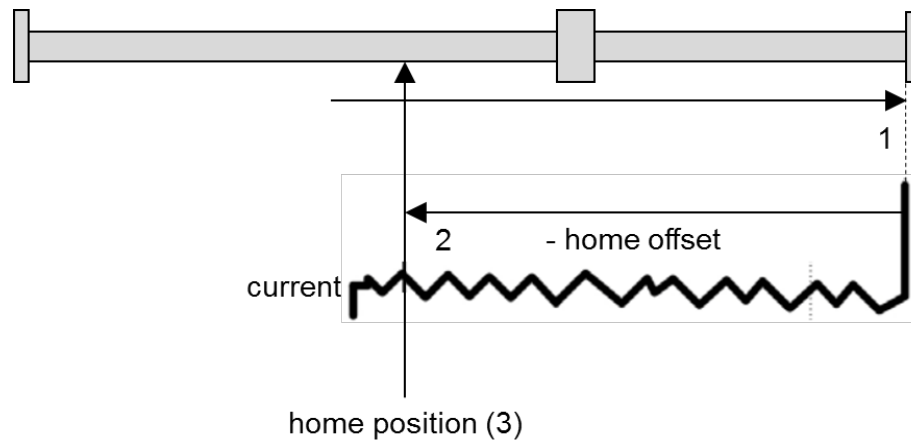
- A) Move to positive edge of Negative Limit Switch (1)
- B) Navigate the falling edge of Negative Limit Switch and move by the Home Offset (2)
- C) This point serves as a reference for all subsequent movements and is set to Home Position. (3)



5.8.3.6 Method -3 : Current Threshold Positive Speed

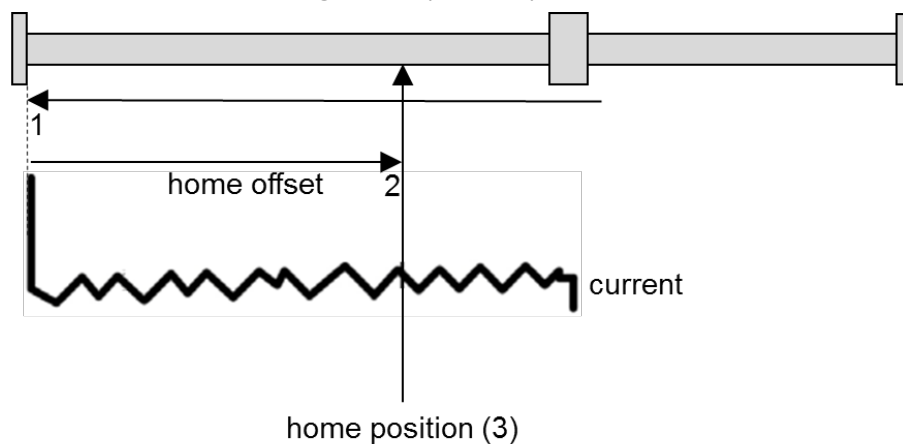
In this method, homing is performed only with forward stopper while driving in a forward direction. This boundary is detected when the average output current exceeds the Current Threshold for Homing Mode (0x4500).

- A) The axis moves in the direction of Stopper at the speed of switch navigation. (1)
- B) Move by the Home Offset (2)
- C) This point serves as a reference for all subsequent movements and is set to Home Position. (3)



5.8.3.7 Method -4 : Current Threshold Negative Speed

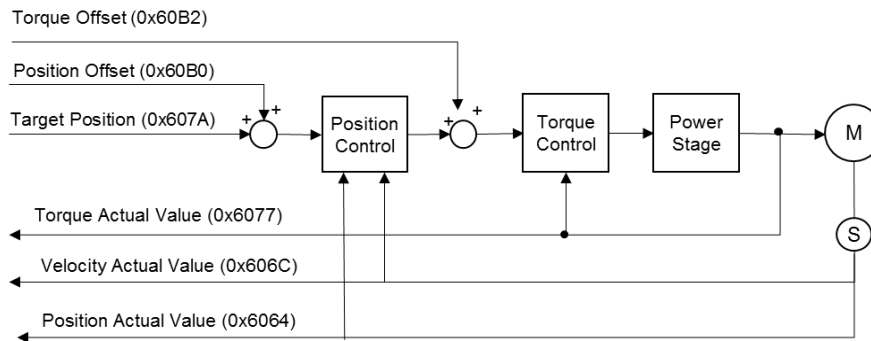
This method performs homing only with the reverse Stopper while driving in a backward direction. This boundary is detected when the average output current exceeds the Current Threshold for Homing Mode (0x4500).



- A) The axis moves in the direction of Stopper at the speed of switch navigation. (1)
- B) Move by the Home Offset (2)
- C) This point serves as a reference for all subsequent movements and is set to Home Position. (3)

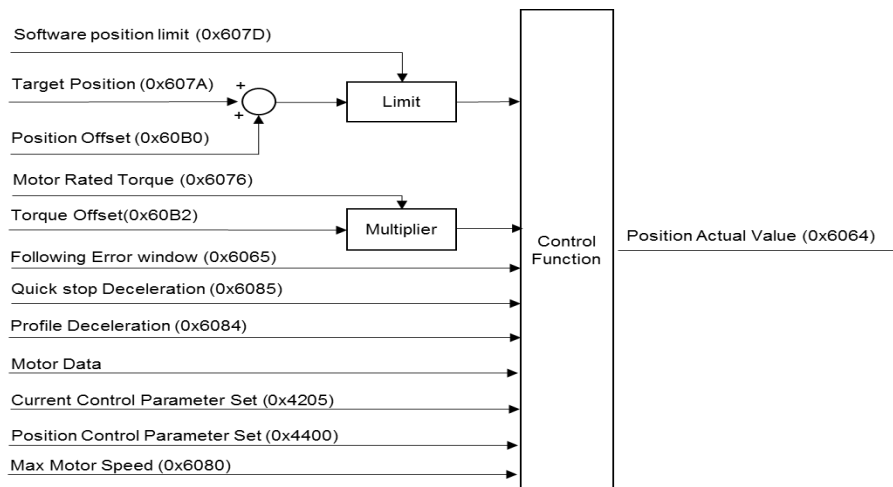
5.9 Position Regulation Mode (PRM)

PR(Position Regulation) mode allows users to enter the target position into the position controller. No trajectory generator is used in this mode. The target position is limited by the Software Position Limit function, and the output of controller is limited by the Max Motor Speed. The output of position controller is affected by the position controller gain setting (the Position Control Parameter Set).



[Position Regulation Mode - Overview]

Input parameters include the target position and position offset. The speed offset is not factored in the parameter. In addition, optional torque offset is used to perform the feed-forward control. The motor data entered is used to define the current value (torque) limits. Among other functions specified in this mode is the Software Position Limit function (used to set limits on the values to avoid any unintended positions) and the max motor speed.



[Position Regulation Mode – Block Diagram]

5.9.1 How to Use PRM

- Configuration Parameter

Parameter	Index	Description
Motor Rated Current	0x6075	Max permissible continuous current of motor
Motor torque constant	0x4003	Torque constant of motor
Current control parameter set	0x4205	Current control gain setting
Position control parameter set	0x4400	Position controller setting
Quick stop deceleration	0x6085	Defines deceleration in the state of Quick stop
Profile deceleration	0x6084	Defines deceleration ramp
Following error window	0x6065	Indicates the max tolerable difference of actual position value and position demand value. If exceeded, the Following Error occurs.
Software position limit	0x607D	Used to set absolute position limits. The Software position limit error is generated if the target or actual position exceeds the limit.
Motor rated torque	0x6076	Retains all relative torque object data.
Max motor speed	0x6080	Indicates the max permissible motor speed. It serves as motor protection and is taken from motor data sheet (operates only in the PDO communication).

[Position Regulation Mode – Configuration Parameters]

- Commanding Parameters

Parameter	Index	Description
Target Position	0x607A	Position input value of position controller (linear interpolation between PDO values)
Position offset	0x60B0	Optional position value that can be added to the target position (linear interpolation between PDO values)
Torque offset	0x60B2	Operational torque feed-forward input

[Position Regulation Mode – Commanding Parameters]

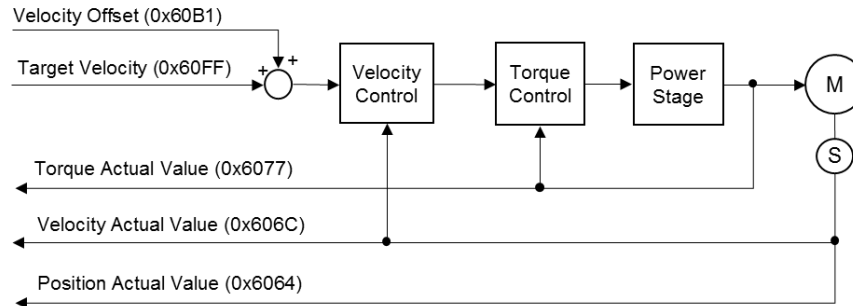
- Output Parameter

Parameter	Index	Description
Torque actual value	0x6077	Actual value of motor torque
Velocity actual value	0x606C	Actual value of speed
Position actual value	0x6064	Actual position is the absolute position against zero position of the system

[Position Regulation Mode – Output Parameters]

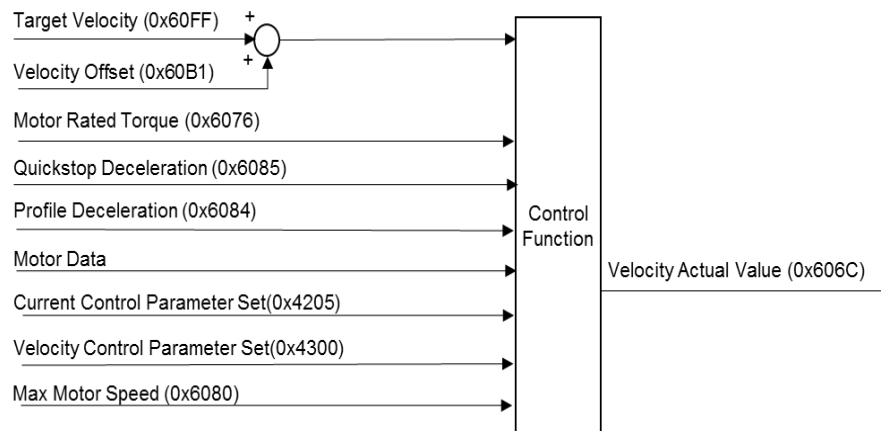
5.10 Velocity Regulation Mode (VRM)

VR(Velocity Regulation) mode is to control the speed by receiving the target velocity. No trajectory generator is used in this mode, and the target velocity is entered directly into the speed controller.



[Velocity Regulation Mode – Overview]

Input parameter is the target velocity. Optionally, additional velocity value can be provided by control system to allow a secondary source to perform the velocity feed-forward control. The torque offset is not factored in the parameter. The motor data entered is used to define the velocity and current value limits.



[Velocity Regulation Mode – Block Diagram]

5.10.1 How to Use VRM

- Configuration Parameter

Parameter	Index	Description
Motor Rated Current	0x6075	Max permissible continuous current of motor
Motor torque constant	0x4003	Torque constant of motor
Current control parameter set	0x4205	Current control gain setting
Velocity control parameter set	0x4300	Speed controller setting
Quick stop deceleration	0x6085	Defines deceleration in the state of Quick stop
Profile deceleration	0x6084	Defines deceleration ramp
Software position limit	0x607D	Used to set the absolute position limits. If the target or actual position exceeds the limit, the Software position limit error is generated.
Motor rated torque	0x6076	Retains all relative torque object data.
Max motor speed	0x6080	Indicates the max permissible motor speed. It serves as motor protection and is taken from motor data sheet (only operates in the PDO communication).

[Velocity Regulation Mode – Configuration Parameters]

- Commanding Parameters

Parameter	Index	Description
Target Velocity	0x60FF	Velocity input value of speed controller (linear interpolation between PDO values)
Velocity offset	0x60B1	Optional velocity feed-forward input

[Velocity Regulation Mode – Commanding Parameters]

- Output Parameter

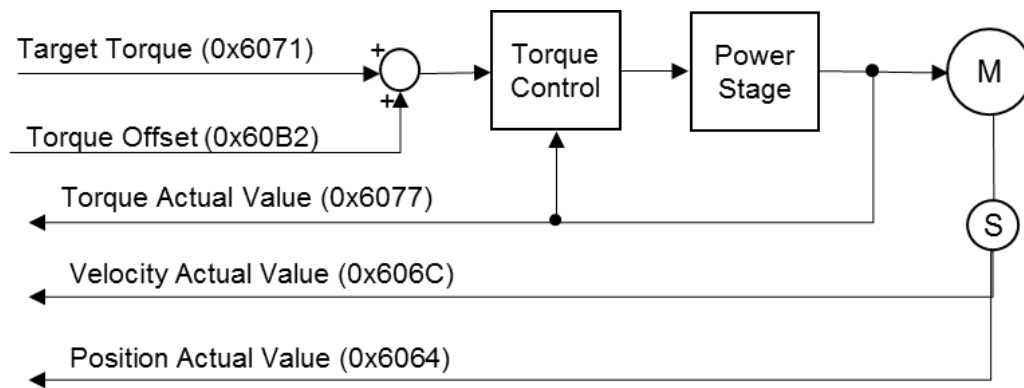
Parameter	Index	Description
Torque actual value	0x6077	Actual value of motor torque
Velocity actual value	0x606C	Actual value of velocity
Position actual value	0x6064	Actual position is the absolute position against zero position of the system

[Velocity Regulation Mode – Output Parameters]

5.11 Torque Regulation Mode (TRM)

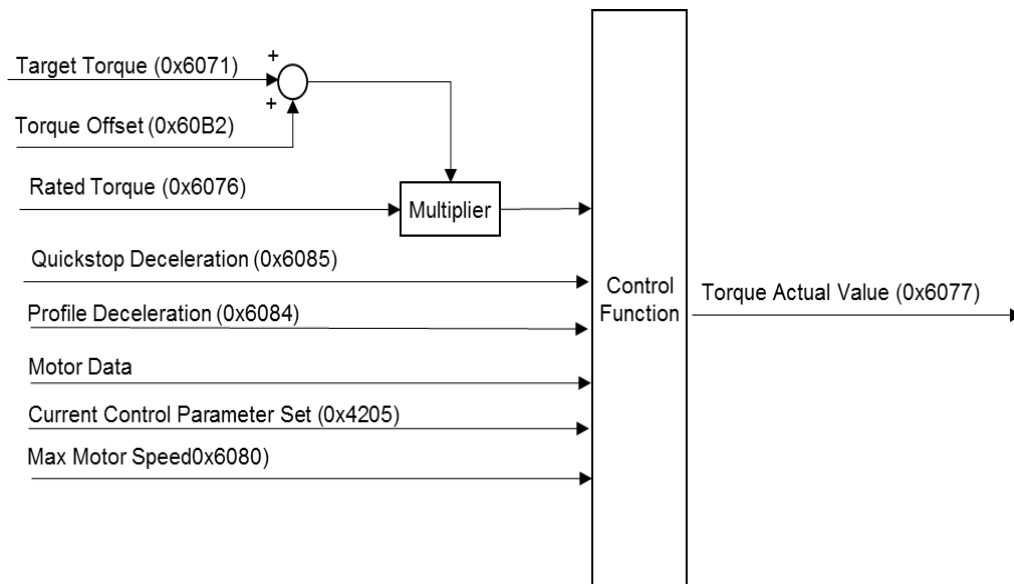
This mode converts the received torque value into current in order to perform the torque control via current control.

In this mode, the torque offset (0x60B2) corresponding to the torque feed-forward can be calculated by the host controller and forwarded to the drive unit.



[Torque Regulation Mode – Overview]

Torque Regulation Mode is based on the current control function. Input parameters include the target torque and the (optional) torque offset. Input motor data is used to define the velocity and current value limits.



[Torque Regulation Mode – Block Diagram]

5.11.1 How to Use TRM

- Configuration Parameter

Parameter	Index	Description
Motor rated torque	0x6076	Retains all relative torque object data.
Max Torque	0x6072	Indicates the max permissible motor torque.
Current control parameter set	0x4205	Current control gain setting

[Torque Regulation Mode – Configuration Parameters]

- Commanding Parameters

Parameter	Index	Description
Target torque	0x6071	Torque input value of torque controller
Torque offset	0x60B2	Optional torque that can be added to the target torque value

[Torque Regulation Mode – Commanding Parameters]

- Output Parameter

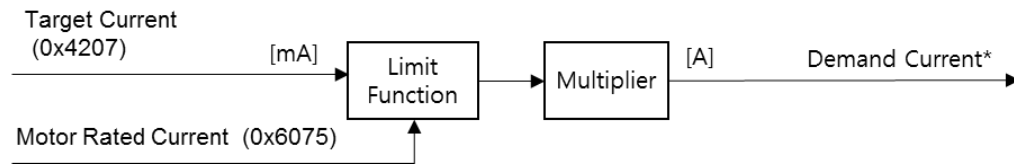
Parameter	Index	Description
Torque actual value	0x6077	Actual value of motor torque
Velocity actual value	0x606C	Actual value of velocity
Position actual value	0x6064	Actual position is the absolute position against zero position of the system

[Torque Regulation Mode – Output Parameters]

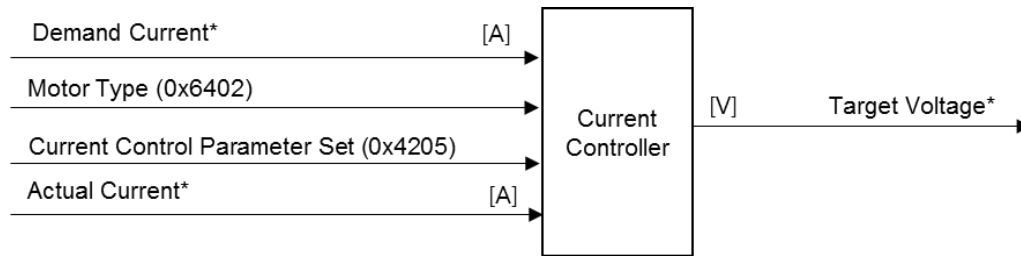
5.12 Current Regulation Mode (CRM)

This mode performs the current control with the received target current value. The target current cannot be set above the rated current.

The current control requires parameter setting such as the type of motor and the current controller gain (Current Control Parameter Set).



The current control requires control parameter setting such as the type of motor and the current controller (Current Control Parameter Set).



[Current Regulation Mode – Block Diagram]

5.12.1 How to Use CRM

- Configuration Parameter

Parameter	Index	Description
Motor Rated Current	0x6075	Max permissible continuous current of motor
Max motor speed	0x6080	Indicates the max permissible motor speed. It serves as motor protection and is taken from motor data sheet.
Current control parameter set	0x4205	Control parameters of current controller
Quick stop deceleration	0x6085	Defines deceleration in the state of Quick stop
Profile deceleration	0x6084	Defines motion profile deceleration
Software position limit	0x607D	Used to set the absolute position limits. If actual position exceeds the limit, the Software position limit error occurs.

[Current Regulation Mode – Configuration Parameters]

- **Commanding Parameters**

Parameter	Index	Description
Target Current	0x4207	Current input value of current controller

[Current Regulation Mode – Commanding Parameters]

- **Output Parameter**

Parameter	Index	Description
Current Actual Value	0x6077	Actual value of motor current
Torque Actual Value	0x6077	Ratio of actual torque to rated torque (0.1%)
Velocity actual value	0x606C	Actual value of velocity
Position actual value	0x6064	Actual position is the absolute position against zero position of the system

5.13 Motion Sequence Mode (MSM)

In the MS(Motion Sequence) mode, motions are defined and arranged in the motion table first and then executed according to conditions. Two conditions can be defined for a single motion. If both conditions are met, the next motion is executed under the first condition. Up to 10 motions can be registered to the motion table.

The motion table can be organized as follows.

Motion0 (0x4710)	Motion1 (0x4711)	...	Motion9 (0x4790)
Modes of Operation	Modes of Operation	...	Modes of Operation
Target Value	Target Value	...	Target Value
Parameter0	Parameter0	...	Parameter0
Parameter1	Parameter1	...	Parameter1
Parameter2	Parameter2	...	Parameter2
Parameter3	Parameter3	...	Parameter3
Next Motion Condition Type A	Next Motion Condition Type A	...	Next Motion Condition Type A
Next Motion Condition Value A	Next Motion Condition Value A	...	Next Motion Condition Value A
Next Motion Index A	Next Motion Index A	...	Next Motion Index A
Next Motion Condition Type B	Next Motion Condition Type B	...	Next Motion Condition Type B
Next Motion Condition Value B	Next Motion Condition Value B	...	Next Motion Condition Value B
Next Motion Index B	Next Motion Index B	...	Next Motion Index B

The motion modes that can be configured in the motion table are as follows.

Value	Description
6	Homing Mode(HM)
3	Profile Velocity Mode(PVM)
1	Profile Position Mode(PPM)
-10	Torque Regulation Mode(TRM)

- Motion Parameters**

Modes of Operation refer to the mode of active motion. Target Value is the output value that is aimed for from the Modes of Operation. If the Modes of Operation are in the Homing Mode, the Target Value serves as the Homing Method. Parameter0, Parameter1, Parameter2, and Parameter3 are the control parameters required for each mode of operation. Target Value, Parameter0, Parameter1, Parameter2, and Parameter3 for the Modes of Operation are defined and tabulated as follows.

Subindex	Profile Position Mode	Profile Velocity Mode	Torque Regulation Mode	Homing Mode
Modes of Operation (0x01)	1	3	-10	6
Target Value (0x02)	Target Position	Target Velocity	Target Torque	Homing Method
Parameter0 (0x03)	Profile Velocity	Profile Acceleration	-	Switch Search Velocity
Parameter1 (0x04)	Profile Acceleration	Profile Deceleration	-	Zero Search Velocity
Parameter2 (0x05)	Profile Deceleration	-	-	Homing Acceleration
Parameter3 (0x06)	Profile Jerk	-	-	Home Offset

The condition that initiates the next motion is established in the Next Motion Condition Type A(or B) and Next Motion Condition Value A(or B). Next Motion Index A(or B) is the index of a motion that is performed when the condition initiating the next motion is met. The types of the Next Motion Conditions are as follows.

Value	Name	Description
0	None	No execution on next motion
1	Target Reached	Execute next motion after completing the motion in operation
2	Target Reached and Wait	Upon completion of motion in operation, standby for next motion during the time specified in Sub-index 0x08
3	Less than position	Execute next motion if current position value is smaller than the one specified in the Next Motion Condition Value
4	More than position	Execute next motion if current position value is greater than the one specified in the Next Motion Condition Value
5	Duration	After completing the current motion, standby for next motion during the time specified in the Next Motion Condition Value
6	External Load Torque/Force	Execute next motion if external load is greater than the value specified in the Next Motion Condition Value
7	Digital Input	Execute next motion if data received via digital input port has the same value as the one specified in the Next Motion Condition Value

The index can be set for the next motion when the condition is met with the Next Motion Index value setting. Based on this, the next motion can be set to operate, stop, or shutdown. The setting values are as follows.

Value	Description
0x0000	Motion Complete
0x0001	Quick Stop
0x0002	Disable Operation
0x0003	Shutdown
0x4710 ~ 0x4719	Next Motion Index
Other value	Motion Complete

By setting a motion table, motions can automatically operate according to the execution order and conditions.

6. Object Dictionary (OD)

Object Dictionary (OD) is a naming system that provides a unique identifier to each “Object” that is delivered via communication. An Object is identified by an index, and the composite Object is identified by a sub-index. CANopen client may manipulate an object of the CANopen server based on its identifier depending on the object’s access rights, which support read only, write only, and read-write attributes. In the CiA DS301, the mandatory object set is required for every CANopen device. If supported, other OD entries are pre-defined by CiA DS 301 and have static identifiers. The OD can also have a manufacturer-specific Object.

6.1 Overview

6.1.1 Object Data Types

Name	Base Type	Description	Size [Bits]	Range
BOOLEAN	BOOL	False/True	1	0, 1
INTEGER8	SINT	Short Integer	8	-128~127
INTEGER16	INT	Integer	16	-32768 ~32767
INTEGER32	DINT	Double Integer	32	-2^{31} ~ $2^{31}-1$
INTEGER64	LINT	Long Integer	64	-2^{63} ~ $2^{63}-1$
UNSIGNED8	USINT	Unsigned Short Integer	8	0 ~ 255
UNSIGNED16	UINT	Unsigned Integer	16	0 ~ 65535
UNSIGNED32	UDINT	Unsigned Double Integer	32	0 ~ $2^{32}-1$
UNSIGNED64	ULINT	Unsigned Long Integer	64	0 ~ $2^{64}-1$
VISIBLE_STRING	STRING	Visible String(1 octet per character)	8*n	-
RECORD		Structure of other types	-	-

6.1.2 Object Access Types

Access Types	Description
RW	Read and write access
RO	Read only access
WO	Write only access
CONST	Read only access value is constant

6.1.3 Entries Overview

Index	Name	Data Type
0x1000	Device Type	UNSIGNED32
0x1001	Error Register	UNSIGNED8
0x1008	Manufacturer Device Name	VISIBLE_STRING
0x1009	Manufacturer Hardware Version	VISIBLE_STRING
0x100A	Manufacturer Software Version	VISIBLE_STRING
0x1010	Save Parameters	RECORD
0x1011	Restore Parameters	RECORD
0x1014	COB-ID Emergency Object	UNSIGNED32
0x1016	Consumer Heartbeat Time	RECORD
0x1017	Producer Heartbeat Time	UNSIGNED16
0x1018	Identity Object	RECORD
0x1029	Error Behavior	RECORD
0x1400~0x1403	Receive PDO #1~#4 Communication Parameters	RECORD
0x1600~0x1603	Receive PDO#1~#4 Mapping Parameters	RECORD
0x1604	Receive PDO#5 Mapping Parameters	RECORD
0x1605	Receive PDO#6 Mapping Parameters	RECORD
0x1606	Receive PDO#7 Mapping Parameters	RECORD
0x1607	Receive PDO#8 Mapping Parameters	RECORD
0x1608	Receive PDO#9 Mapping Parameters	RECORD
0x1609	Receive PDO#10 Mapping Parameters	RECORD
0x1800~0x1803	Transmit PDO#1~#4 Communication Parameters	RECORD
0x1A00~0x1A03	Transmit PDO#1~#4 Mapping Parameters	RECORD
0x1A04	Transmit PDO#5 Mapping Parameters	RECORD
0x1A05	Transmit PDO#6 Mapping Parameters	RECORD
0x1A06	Transmit PDO#7 Mapping Parameters	RECORD
0x1A07	Transmit PDO#8 Mapping Parameters	RECORD
0x1A08	Transmit PDO#9 Mapping Parameters	RECORD
0x1A09	Transmit PDO#10 Mapping Parameters	RECORD
0x1C00	Sync Manager Communication Type	ARRAY
0x1C12	Sync Manager Ch2	RECORD
0x1C13	Sync Manager Ch3	RECORD
0x4000	Resistance	UNSIGNED16
0x4001	Inductance(Q-Axis Inductance)	UNSIGNED32

0x4002	D-Axis Inductance	UNSIGNED32
0x4003	Torque Constant	UNSIGNED32
0x4004	Back-EMF Constant	UNSIGNED32
0x4005	System Inertia	UNSIGNED32
0x4006	Coulomb(Static) Friction	UNSIGNED32
0x4007	Viscos Friction	UNSIGNED32
0x4008	Position Sensor Type	UNSIGNED8
0x4009	Position Sensor Polarity	UNSIGNED8
0x400A	Hall Sensor Pole Pair	UNSIGNED8
0x4080	Error History	RECORD
0x4100	Motor Phase	UNSIGNED8
0x4101	Electric Angle Offset	INTEGER16
0x4107	Hall Sensor Pattern	UNSIGNED8
0x4205	Current Control Parameter Set	RECORD
0x4206	Current Controller Bandwidth	UNSIGNED16
0x4207	Target Current	INTEGER32
0x4208	Actual Current	INTEGER32
0x4209	Averaged Current (Moving Averaged 10step)	INTEGER32
0x4300	Velocity Control Parameter Set	RECORD
0x4301	Velocity Controller Bandwidth	UNSIGNED16
0x4302	I2T Over Load Protection	RECORD
0x4310	Velocity Kalman Filter Covariance	UNSIGNED32
0x4311	External Load Torque Feed-Forward Gain	UNSIGNED8
0x4312	External Load Torque Deadzone	UNSIGNED8
0x4313	Load Torque	INTEGER32
0x4314	Load Torque Threshold	UNSIGNED32
0x4321	Velocity Auto-Tuning Acceleration	UNSIGNED32
0x4322	Velocity Auto-Tuning Velocity	UNSIGNED32
0x4323	Velocity Auto-Tuning Position	INTEGER32
0x4400	Position Control Parameter Set	RECORD
0x4500	Current Threshold for Homing Mode	UNSIGNED32
0x4600	Temperature	UNSIGNED8
0x4601	Regenerator Clamp Cut-off Voltage	UNSIGNED16
0x4610	Brake Parameters	RECORD

0x4620	Collision Detection	RECORD
0x4700	Target Motion Info	RECORD
0x4701	Actual Motion Index	UNSIGNED16
0x4702	Motion Error History	RECORD
0x4710~0x4719	Motion0 ~Motion9	RECORD
0x5000	ID for CAN, UART	UNSIGNED8
0x5001	UART Baudrate	UNSIGNED8
0x5002	CAN Bitrate	UNSIGNED8
0x4620	Collision Detection	RECORD
0x4700	Target Motion Info	RECORD
0x4701	Actual Motion Index	UNSIGNED16
0x4702	Motion Error History	RECORD
0x4710~0x4719	Motion0 ~Motion9	RECORD
0x5000	ID for CAN, UART	UNSIGNED8
0x5001	UART Baudrate	UNSIGNED8
0x5002	CAN Bitrate	UNSIGNED8
0x5010	Analog Input	RECORD
0x6007	Abort Connection Option Code	INTEGER16
0x603F	Error Code	UNSIGNED16
0x6040	Controlword	UNSIGNED16
0x6041	Statusword	UNSIGNED16
0x6042	VL Mode Target Velocity	INTEGER16
0x6043	VL Mode Demand Velocity	INTEGER16
0x6044	VL Mode Actual Velocity	INTEGER16
0x6046	VL Mode Velocity Min. Max. Amount	RECORD
0x6048	VL Mode Velocity Acceleration	RECORD
0x6049	VL Mode Velocity Deceleration	RECORD
0x604A	VL Mode Velocity Quick Stop Deceleration	RECORD
0x605A	Quick Stop Option Code	INTEGER16
0x605B	Shutdown Option code	INTEGER16
0x605C	Disable Operation Option Code	INTEGER16
0x605D	Halt Option Code	INTEGER16
0x605E	Fault Reaction Option Code	INTEGER16
0x6060	Modes of Operation	INTEGER8

0x6061	Modes of Operation Display	INTEGER8
0x6062	Position Demand Value	INTEGER32
0x6063	Internal Position Actual Value	INTEGER32
0x6064	Position Actual Value	INTEGER32
0x6065	Following Error Window	UNSIGNED32
0x6067	Position Window	UNSIGNED32
0x6068	Position Window Time	UNSIGNED16
0x606B	Velocity Demand Value	INTEGER32
0x606C	Velocity Actual Value	INTEGER32
0x606D	Velocity Window	UNSIGNED32
0x606E	Velocity Window Time	UNSIGNED16
0x6071	Target Torque	INTEGER16
0x6072	Maximum Torque	UNSIGNED16
0x6073	Maximum Current	UNSIGNED16
0x6074	Torque Demand Value	INTEGER16
0x6075	Motor Rated Current	UNSIGNED32
0x6076	Motor Rated Torque	UNSIGNED32
0x6077	Torque Actual Value	INTEGER16
0x6078	Current Actual Value	INTEGER16
0x6079	DC Link Circuit Voltage	UNSIGNED32
0x607A	Target Position	INTEGER32
0x607C	Home Offset	INTEGER32
0x607D	Software Position Limit	ARRAY
0x607F	Max. Profile Velocity	UNSIGNED32
0x6080	Maximum Motor Speed	UNSIGNED32
0x6081	Profile Velocity	UNSIGNED32
0x6083	Profile Acceleration	UNSIGNED32
0x6084	Profile Deceleration	UNSIGNED32
0x6085	Quickstop Deceleration	UNSIGNED32
0x6086	Motion Profile Type	INTEGER16
0x6089	Position Notation Index	INTEGER8
0x608A	Position Dimension Index	UNSIGNED8
0x608B	Velocity Notation Index	INTEGER8
0x608C	Velocity Dimension Index	UNSIGNED8

0x608D	Acceleration Notation Index	INTEGER8
0x608E	Acceleration Dimension Index	UNSIGNED8
0x608F	Position Encoder Resolution	RECORD
0x6098	Homing Method	INTEGER8
0x6099	Homing Speeds	RECORD
0x609A	Homing Acceleration	UNSIGNED32
0x60A4	Profile Jerk	RECODD
0x60B0	Position Offset	INTEGER32
0x60B1	Velocity Offset	INTEGER32
0x60B2	Torque Offset	INTEGER16
0x60C5	Maximum Acceleration	UNSIGNED32
0x60C6	Maximum Deceleration	UNSIGNED32
0x60E3	Supported Homing Methods	RECODD
0x60F4	Following Error Actual Value	INTEGER32
0x60FD	Digital Inputs	UNSIGNED32
0x60FE	Digital Outputs	RECORD
0x60FF	Target Velocity	INTEGER32
0x6402	Motor Type	UNSIGNED16
0x6502	Supported Drive Modes	UNSIGNED32

6.2 Object

6.2.1 0x1001 : Device Type

This object describes the device type and function. It consists of 16-bit field that describes the device profiles used and the 16-bit field that provides additional information on the optional functions of the device.

The low word indicates the profile number of the supported device.

The value 0x0192(402) indicates that the device conforms to the CANopen device profile for CiA402 drive and motion control. The high word holds information on the drive types. The value 0x0002 means that the drive is a servo-drive.

Name	Device type
Index	0x1000
Sub Index	0x00
Data Type	UNSIGNED32
Access Type	RO
Unit	-
Default Value	0x00020192
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.2 0x1001 : Error Register

This object refers to the device error register. The device performs the mapping of internal errors to this object.

Name	Error Register
Index	0x1001
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Bit	Description
0	Generic Error
1	Current Error
2	Voltage Error
3	Temperature Error
4	Communication Error
5	Device Profile Error
6	Reserved
7	Manufacturer Error

6.2.3 0x1008 : Manufacturer Device Name

This object indicates the manufacturer device name.

Name	Manufacturer Device Name	
Index	0x1008	
Sub Index	0x00	
Data Type	VISIBLE_STRING	
Access Type	CONST	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.4 0x1009 : Manufacturer Hardware Version

This object indicates the manufacturer hardware version.

Name	Manufacturer Hardware Version	
Index	0x1009	
Sub Index	0x00	
Data Type	VISIBLE_STRING	
Access Type	CONST	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.5 0x100A : Manufacturer Software Version

This object indicates the manufacturer software version.

Name	Manufacturer Software Version	
Index	0x100A	
Sub Index	0x00	
Data Type	VISIBLE_STRING	
Access Type	CONST	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.6 0x1010 : Save Parameters

This object is used to store parameters in non-volatile memory. In order to avoid accidental storage, the save operation is executed only when a specific signature (“save”) is written to the corresponding subindex.

Name	Save Parameters	
Index	0x1010	
Data Type	Record	
Number of Entries	1	

6.2.6.1 Save all Parameters

With the signature “save” written on an object, all controller parameters are stored to non-volatile memory.

Name	Save all Parameters	
Index	0x1010	
Sub Index	0x01	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Number	
Default Value	NO	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

BYTE	MSB			LSB
Character	'e'	'v'	'a'	's'
Hex Value	0x65	0x76	0x61	0x73

6.2.7 0x1011 : Restore Parameters

This object is used to restore parameters from non-volatile memory.

Restoring a parameter to its default values can be performed only in the NMT state [Pre-Operational] and device state [Power Disable]. The default values are valid only after the device is reset or power cycled.

In order to avoid accidental storage, the restore operation is executed only when a specific signature ("load") is written to the corresponding sub-index.

Name	Restore Parameters
Index	0x1011
Data Type	RECORD
Number of Entries	1

On read access, the device always returns the value 0x00000001.

6.2.7.1 Restore Default Parameters

With the signature "load" written on an object, all controller parameters are stored to non-volatile memory. This is allowed only when the device status is «Power Disable».

Name	Restore Default Parameters
Index	0x1011
Sub Index	0x01
Data Type	UNISIGNED32
Access Type	RW
Unit	Number
Default Value	NO
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

BYTE	MSB			LSB
Character	'd'	'a'	'0'	'l'
Hex Value	0x65	0x76	0x61	0x73

6.2.8 0x1014 : COB-ID Emergency Object

This object defines the communication object identifier (COB-ID) for the Emergency Object. The following table provides descriptions of the object.

Name	COB-ID Emergency Object	
Index	0x1014	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Number	
Default Value	0x81 (0x80 + Node-ID)	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen	

6.2.9 0x1016 : Consumer Heartbeat Time

Consumer heartbeat time defines the expected heartbeat cycle time. Therefore, this value should be greater than the corresponding producer heartbeat time (0x1017) configured on the device.

Monitoring starts after the first heartbeat is received. If the heartbeat time is 0 for the Consumer Heartbeat Time, the corresponding object entry is disabled. The time duration should be in multiples of 1ms. It is advised to set the Consumer Heartbeat Time value at least 20ms greater than the Producer Heartbeat Time value (0x1017).

Typically, the master (or other slave) generates the heartbeat. Therefore, if the Producer Node-ID configured for this object is the same as the Node-ID currently in use by this device, then it may not operate properly.

Name	Consumer Heartbeat Time	
Index	0x1016	
Data Type	RECORD	
Number of Entries	1	

6.2.9.1 Consumer Heartbeat Time

Name	Consumer Heartbeat Time	
Index	0x1016	
Sub Index	0x01	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	msec	
Default Value	0	
Value Range	-	4294967296
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen	

Bit 31...24	Bit 23...16	Bit 15...0
Reserved (0)	Node-ID	Heartbeat Time

6.2.10 0x1017 : Producer Heartbeat Time

This object defines the cycle time (duration) of the heartbeat. The Producer Heartbeat Time, which is 0, is disabled.

The duration time must be a multiple of 1ms.

Name	Producer Heartbeat Time	
Index	0x1017	
Sub Index	0x00	
Data Type	UNISIGNED16	
Access Type	RW	
Unit	msec	
Default Value	0	
Value Range	-	65536
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen	

6.2.11 0x1018 : Identity Object

This object provides the general identification information on the device.

Name	Identity Object
Index	0x1018
Data Type	RECORD
Number of Entries	4

6.2.11.1 Vender ID

This provides information on the unique vendor ID specified in the CiA.

Name	Vendor ID
Index	0x1018
Sub Index	0x01
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.11.2 Product Code

This indicates the product code.

Name	Product Code
Index	0x1018
Sub Index	0x02
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.11.3 Revision Number

This provides information on the product version.

Name	Revision Number
Index	0x1018
Sub Index	0x03
Data Type	UNUNSIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.11.4 Serial Number

This provides information on the product serial number.

Name	Serial Number
Index	0x1018
Sub Index	0x04
Data Type	UNUNSIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.12 0x1029 : Error Behavior

This object reports the CAN communication status after a heartbeat failure. The object value can be defined by the CAN communication status reported after a heartbeat failure as follows.

- 0 : preoperational (only if current state is operational)
- 1 : no status change
- 2 : interrupted

The default value is 1 (no status change).

Name	Error Behavior
Index	0x1029
Data Type	RECORD
Number of Entries	2

6.2.12.1 Communication Error

This object provides information on the execution in the event of communication error.

Name	Communication Error
Index	0x1029
Sub Index	0x01
Data Type	UNISIGNED8
Access Type	RW
Unit	Number
Default Value	1
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	PRE-OP (only if current state is operational)
1	No State Change
2	STOPPED

6.2.12.2 Application Error

Name	Application Error
Index	0x1029
Sub Index	0x02
Data Type	UNISIGNED8
Access Type	RW
Unit	Number
Default Value	1
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	PRE-OP (only if current state is operational)
1	No State Change
2	STOPPED

6.2.13 0x1400 : Receive PDO #1~#4 Communication Parameters (0x1403~0x1403)

Name	Receive PDO #1~#4 Communication Parameters
Index	0x1400 ~ 0x1403
Data Type	RECORD
Number of Entries	2

6.2.13.1 COB-ID used by Receive PDO #1 ~ #4

This object provides information on the communication object identifier of the received process data object

Name	COB-ID used by Receive PDO #1 ~ #4
Index	0x1400 ~ 0x1403
Sub Index	0x01
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	See table below
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen

Index	Description
0x1400	RPDO1 0x1600 COB-ID = 0x200
0x1401	RPDO2 0x1601 COB-ID = 0x300
0x1402	RPDO3 0x1602 COB-ID = 0x400
0x1403	RPDO4 0x1603 COB-ID = 0x500

6.2.13.2 Transmission Type of Receive PDO #1 ~ #4

Name	Transmission Type of Receive PDO #1 ~ #4	
Index	0x1400 ~ 0x1403	
Sub Index	0x02	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	-	
Default Value	255 (0xFF)	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen	

Value	Description
0	Synchronous transmission performed once, at next SYNC
N	N=1...240 Synchronous transmission performed once per $0 < N \leq 240$ accepted SYNC signals.
254	Asynchronous transmission in response to a manufacturer-specific event.
255	Asynchronous transmission in response to a device profile (such as DSP 402).

6.2.14 0x1600 : Receive PDO #1~#4 Mapping Parameters (0x1403~0x1403)

This object contains the RxPDO mapping parameters. PDO requires an object mapping. Subindex 0 represents the number of the mapped objects. Subindices 0x01 ... 0x0A indicate the mapped objects describing the corresponding index, subindex, and length.

The value of length (bit) is used to calculate the total mapping length. The max allowable lengths for the mapped objects are as follows.

- CANopen : 8 Byte
- EtherCAT: 40 Byte

Write access is only allowed in the [Pre-Operational] NMT state.

The structure of the objects mapped to subindices 0x01 ... 0x0A is as follows.

Bit 31...16	Bit 15...8	Bit 7...0
Index	Subindex	Length

In order to make changes to the PDO mapping, the following process must be completed.

- a) write the value "0" to subindex 0x00 (disable PDO).
- b) modify the desired object from subindices 0x01 ~ 0x0n.
- c) write the desired number of the mapped objects to subindex 0x00.

Name	Receive PDO #1 ~ #4 Mapping Parameters
Index	0x1600 ~ 0x1603
Data Type	RECORD
Number of Entries	0

6.2.14.1 Number of mapped object in RxPDO

Name	Number of mapped object in RxPDO	
Index	0x1600 ~ 0x1603	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	-	
Default Value	0	
Value Range	0	0x0A
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.14.2 RxPDO #1 ~ #4 Mapping Parameter #1 ~ #10

Name	RxPDO #1~#4 Mapping Parameter #1~#10	
Index	0x1600 ~ 0x1603	
Sub Index	0x00 ~ 0x0A	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.15 0x1604 : Receive PDO #5 Mapping Parameters

This object contains the process data mapping parameters specified in RxPDO5.

Name	Receive PDO #5 Mapping Parameters
Index	0x1604
Data Type	RECORD
Number of Entries	3

Name	RxPDO #5 Mapping Parameters
Index	0x1604
Sub Index	0x01 ~ 0x03
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	-
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1604	0x00	UNISIGNED8	3	Number of mapped object in RxPDO
	0x01	UNISIGNED32	0x60400010	ControlWord : UNISIGNED16

6.2.16 0x1605 : Receive PDO #6 Mapping Parameters

This object contains the process data mapping parameters specified in RxPDO6.

Name	Receive PDO #6 Mapping Parameters
Index	0x1605
Data Type	RECORD
Number of Entries	4

Name		RxPDO #6 Mapping Parameters	
Index		0x1605	
Sub Index		0x01 ~ 0x04	
Data Type		UNISIGNED32	
Access Type		RO	
Unit		-	
Default Value		-	
Value Range		-	-
PDO Mapping		NO	
Backup		NO	
Fieldbus Type		EtherCAT	

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1605	0x00	UNSIGNED8	4	Number of mapped object in RxPDO
	0x01	UNSIGNED32	0x60400010	ControlWord : UNSIGNED16
	0x02	UNSIGNED32	0x607A0020	TargetPosition : INTEGER32
	0x03	UNSIGNED32	0x60B20010	TorqueOffset : INTEGER16
	0x04	UNSIGNED32	0x60FE0120	DigitalOutput : UNSIGNED32

6.2.17 0x1606 : Receive PDO #7 Mapping Parameters

This object contains the process data mapping parameters specified in RxPDO7.

Name		Receive PDO #7 Mapping Parameters	
Index		0x1606	
Data Type		RECORD	
Number of Entries		3	

Name		RxPDO #7 Mapping Parameters	
Index		0x1606	
Sub Index		0x01 ~ 0x03	
Data Type		UNISIGNED32	
Access Type		RO	
Unit		-	
Default Value		-	
Value Range		-	-
PDO Mapping		NO	
Backup		NO	
Fieldbus Type		EtherCAT	

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1606	0x00	UNSIGNED8	3	Number of mapped object in RxPDO
	0x01	UNSIGNED32	0x60400010	ControlWord : UNSIGNED16
	0x02	UNSIGNED32	0x60FF0020	TargetVelocity : INTEGER32
	0x03	UNSIGNED32	0x60FE0120	DigitalOutput : UNSIGNED32

6.2.18 0x1607 : Receive PDO #8 Mapping Parameters

This object contains the process data mapping parameters specified in RxPDO8.

Name	Receive PDO #8 Mapping Parameters
Index	0x1607
Data Type	RECORD
Number of Entries	3

Name	RxPDO #8 Mapping Parameters
Index	0x1607
Sub Index	0x01 ~ 0x03
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	-
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1607	0x00	UNSIGNED8	3	Number of mapped object in RxPDO
	0x01	UNSIGNED32	0x60400010	ControlWord : UNSIGNED16
	0x02	UNSIGNED32	0x60710010	TargetTorque : INTEGER16
	0x03	UNSIGNED32	0x60FE0120	DigitalOutput : UNSIGNED32

6.2.19 0x1608 : Receive PDO #9 Mapping Parameters

This object contains the process data mapping parameters specified in RxPDO9.

Name	Receive PDO #9 Mapping Parameters
Index	0x1608
Data Type	RECORD
Number of Entries	6

Name	RxPDO #9 Mapping Parameters
Index	0x1608
Sub Index	0x01 ~ 0x06
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1608	0x00	UNSIGNED8	6	Number of mapped object in RxPDO
	0x01	UNSIGNED32	0x60400010	ControlWord : UNSIGNED16
	0x02	UNSIGNED32	0x607A0020	Motion Option Code : UNSIGNED8
	0x03	UNSIGNED32	0x60FF0020	Target Motion Index : UNSIGNED16
	0x04	UNSIGNED32	0x60710010	Motion Modes Of Operation : INTEGER8
	0x05	UNSIGNED32	0x60FE0120	Motion Target : INTEGER32
	0x06	UNSIGNED32	0x60600008	Motion Parameter1 : INTEGER32

6.2.20 0x1609 : Receive PDO #10 Mapping Parameters

This object contains the process data mapping parameters specified in RxPDO10.

Name	Receive PDO #10 Mapping Parameters
Index	0x1609
Data Type	RECORD
Number of Entries	9

Name	RxPDO #10 Mapping Parameters	
Index	0x1609	
Sub Index	0x01 ~ 0x09	
Data Type	UNISIGNED32	
Access Type	RO	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	EtherCAT	

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1609	0x00	UNISIGNED8	9	Number of mapped object in RxPDO
	0x01	UNISIGNED32	0x60400010	ControlWord : UNISIGNED16
	0x02	UNISIGNED32	0x47000108	Motion Option Code : UNISIGNED8
	0x03	UNISIGNED32	0x47000210	Target Motion Index : UNISIGNED16
	0x04	UNISIGNED32	0x47000308	Motion Modes Of Operation : INTEGER8
	0x05	UNISIGNED32	0x47000420	Motion Target : INTEGER32
	0x06	UNISIGNED32	0x47000520	Motion Parameter1 : INTEGER32
	0x07	UNISIGNED32	0x47000620	Motion Parameter2 : INTEGER32
	0x08	UNISIGNED32	0x47000720	Motion Parameter3 : INTEGER32
	0x09	UNISIGNED32	0x47000820	Motion Parameter4 : INTEGER32

6.2.21 0x1800 : Transmit PDO #1 ~#4 Communication Parameters (0x1800~0x1803)

Name	Transmit PDO #1~ #4 Communication Parameters
Index	0x1800 ~ 0x1803
Data Type	RECORD
Number of Entries	5

6.2.21.1 COB-ID used by Transmit PDO #1 ~#4

This indicates the communication object identifier of the transmitted process data object.

Name	COB-ID used by Transmit PDO#1~#4
Index	0x1800 ~ 0x1803
Sub Index	0x01
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	-
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen

Index	Description
0x1800	TPDO1 0x1A00 COB-ID = 0x40000180
0x1801	TPDO2 0x1A01 COB-ID = 0x40000280
0x1802	TPDO3 0x1A02 COB-ID = 0x40000380
0x1803	TPDO4 0x1A03 COB-ID = 0x40000480

6.2.21.2 Transmission Type of Transmit PDO #1 ~#4

Name	Transmission Type of Transmit PDO#1~#4
Index	0x1800 ~ 0x1803
Sub Index	0x02
Data Type	UNISIGNED8
Access Type	RW
Unit	-
Default Value	0
Value Range	-
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen

Value	Description
0	Synchronous transmission performed once, at next SYNC
N	N=1...240 Synchronous transmission performed once per $0 < N \leq 240$ accepted SYNC signals.
254	Asynchronous transmission in response to a manufacturer-specific event.
255	Asynchronous transmission in response to a device profile (such as DSP 402).

6.2.21.3 Inhibit Time of Transmit PDO #1 ~#4

Name	Inhibit Time of Transmit PDO#1~#4	
Index	0x1800 ~ 0x1803	
Sub Index	0x03	
Data Type	UNISIGNED16	
Access Type	RW	
Unit	-	
Default Value	0	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen	

Value	Description
0	no inhibit time between messages - Inhibit time specifications do not relate to the generating event but to the transmission of the TPDO. The inhibit time resolution is 100 microseconds. The exact inhibit times are not very accurate and can actually be up to 2 milliseconds (20 units of inhibit time) longer than defined by sub-index 3 of this object. For example, if an inhibit time is specified as 10 milliseconds, its actual inhibit time length may vary in the range of [10...12] milliseconds.

6.2.21.4 Time of Transmit PDO #1 ~#4

Name	Event Timer of Transmit PDO#1~#4	
Index	0x1800 ~ 0x1803	
Sub Index	0x05	
Data Type	UNISIGNED16	
Access Type	RW	
Unit	-	
Default Value	0	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen	

Value	Description
0	Not used. When a TPDO transmission type is 254 or 255, an event time can be used. The event occurs when the time is elapsed. The event time elapse is a multiple of 1 millisecond of sub-index 5. It causes the transmission of this PDO in addition to other asynchronous events. The occurrence of an event sets the timer again. A value of 0 disables this function. The transmission of the TPDO has an accuracy with 2 milliseconds.

6.2.22 0x1A00 : Transmit PDO #1 ~#4 Mapping Parameters (0x1A00~0x1A03)

This object contains the process data mapping parameters of TxPDO. The process data exchange with PDOs requires an object mapping. Subindex 0x00 represents the number of the mapped objects. Subindices 0x01 ... 0x0A indicate the mapped objects that contain information on their corresponding index, subindex, and length.

The value of length (bit) is used to calculate the total mapping length.

The max allowable lengths for the mapped objects are as follows.

- CANopen : 8 byte
- EtherCAT : 40 byte

Write access is only allowed in the [Pre-Operational] NMT state.

The structure of the objects mapped to subindices 0x01 ~ 0x0A.

Bit 31...16	Bit 15...8	Bit 7...0
Index	Subindex	Length

In order to make changes to the PDO mapping, the following process must be completed.

- a) write the value "0" to subindex 0x00 (disable PDO).
- b) modify the desired object from subindices 0x01 ~ 0x0n.
- c) write the number of objects to be mapped to subindex 0x00.

Name	Transmit PDO #1~ #4 Mapping Parameters
Index	0x1A00 ~ 0x1A03
Data Type	RECORD
Number of Entries	0

6.2.22.1 Number of mapped objects in TxPDO #1 ~#4

Name	Number of mapped objects in TxPDO#1~#4	
Index	0x1A00 ~ 0x1A03	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	Number	
Default Value	0	
Value Range	0	0x0A
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.22.2 RxPDO 1 Mapping Parameter #1 ~ #10

Name	RxPDO 1 Mapping Parameter #1~#10	
Index	0x1A00 ~ 0x1A03	
Sub Index	0x00 ~ 0x0A	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.23 0x1A04 : Transmit PDO #5 Mapping Parameters

This object contains the process data mapping parameters specified in TxPDO5.

Name	Transmit PDO #5 Mapping Parameters	
Index	0x1A04	
Data Type	RECORD	
Number of Entries	3	

Name	Transmit PDO #5 Mapping Parameters	
Index	0x1A04	
Sub Index	0x01 ~ 0x03	
Data Type	UNISIGNED32	
Access Type	RO	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	EtherCAT	

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1A04	0x00	UNISIGNED8	3	Number of mapped object in TxPDO
	0x01	UNISIGNED32	0x60410010	StatusWord : UNISIGNED016
	0x02	UNISIGNED32	0x60640020	ActualPosition : INTEGER32
	0x03	UNISIGNED32	0x60FD0020	DigitalInput : UNISIGNED32

6.2.24 0x1A05 : Transmit PDO #6 Mapping Parameters

This object contains the process data mapping parameters specified in TxPDO6.

Name	Transmit PDO #6 Mapping Parameters
Index	0x1A05
Data Type	RECORD
Number of Entries	4

Name	Transmit PDO #6 Mapping Parameters
Index	0x1A05
Sub Index	0x01 ~ 0x04
Data Type	UNSIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1A05	0x00	UNSIGNED8	3	Number of mapped object in TxPDO
	0x01	UNSIGNED32	0x60410010	StatusWord : UNSIGNED016
	0x02	UNSIGNED32	0x60640020	ActualPosition : INTEGER32
	0x03	UNSIGNED32	0x606C0020	ActualVelocity : INTEGER32
	0x04	UNSIGNED32	0x60FD0020	DigitalInput : UNSIGNED32

6.2.25 0x1A06 : Transmit PDO #7 Mapping Parameters

This object contains the process data mapping parameters specified in TxPDO7.

Name	Transmit PDO #7 Mapping Parameters
Index	0x1A06
Data Type	RECORD
Number of Entries	5

Name	Transmit PDO #7 Mapping Parameters	
Index	0x1A06	
Sub Index	0x01 ~ 0x05	
Data Type	UNISIGNED32	
Access Type	RO	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	EtherCAT	

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1A06	0x00	UNISIGNED8	5	Number of mapped object in TxPDO
	0x01	UNISIGNED32	0x60410010	StatusWord : UNISIGNED16
	0x02	UNISIGNED32	0x60640020	ActualPosition : INTEGER32
	0x03	UNISIGNED32	0x606C0020	ActualVelocity : INTEGER32
	0x04	UNISIGNED32	0x60770010	ActualTorque : INTEGER16
	0x05	UNISIGNED32	0x60FD0020	DigitalInput : UNISIGNED32

6.2.26 0x1A07 : Transmit PDO #8 Mapping Parameters

This object contains the process data mapping parameters specified in TxPDO8.

Name	Transmit PDO #8 Mapping Parameters	
Index	0x1A07	
Data Type	RECORD	
Number of Entries	5	

Name	Transmit PDO #8 Mapping Parameters	
Index	0x1A07	
Sub Index	0x01 ~ 0x05	
Data Type	UNISIGNED32	
Access Type	RO	
Unit	-	
Default Value	-	
Value Range	-	-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	EtherCAT	

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1A07	0x00	UNSIGNED8	5	Number of mapped object in TxPDO
	0x01	UNSIGNED32	0x60410010	StatusWord : UNSIGNED16
	0x02	UNSIGNED32	0x60640020	Actual IPosition : INTEGER32
	0x03	UNSIGNED32	0x606C0020	Actual Velocity : INTEGER32
	0x04	UNSIGNED32	0x60780010	Actual Current : INTEGER16
	0x05	UNSIGNED32	0x60FD0020	Digital Input : UNSIGNED32

6.2.27 0x1A08 : Transmit PDO #9 Mapping Parameters

This object contains the process data mapping parameters specified in TxPDO9.

Name	Transmit PDO #9 Mapping Parameters
Index	0x1A08
Data Type	RECORD
Number of Entries	6

Name	Transmit PDO #9 Mapping Parameters
Index	0x1A08
Sub Index	0x01 ~ 0x06
Data Type	UNSIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	-
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1A08	0x00	UNSIGNED8	6	Number of mapped object in TxPDO
	0x01	UNSIGNED32	0x60410010	StatusWord : UNSIGNED16
	0x02	UNSIGNED32	0x60640020	ActualPosition : INTEGER32
	0x03	UNSIGNED32	0x606C0020	ActualVelocity : INTEGER32
	0x04	UNSIGNED32	0x60770010	ActualTorque : INTEGER16
	0x05	UNSIGNED32	0x60FD0020	DigitalInput : UNSIGNED32
	0x06	UNSIGNED32	0x60610008	ModesOfOperationDisplay : INTEGER8

6.2.28 0x1A09 : Transmit PDO #10 Mapping Parameters

This object contains the process data mapping parameters specified in TxPDO10.

Name	Transmit PDO #10 Mapping Parameters
Index	0x1A09
Data Type	RECORD
Number of Entries	6

Name	Transmit PDO #10 Mapping Parameters
Index	0x1A09
Sub Index	0x01 ~ 0x06
Data Type	UNISIGNED32
Access Type	RO
Unit	-
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

CANOpen over EtherCAT				
Index	Subindex	Data Type	Value	Description
0x1A09	0x00	UNISIGNED8	6	Number of mapped object in TxPDO
	0x01	UNISIGNED32	0x60410010	StatusWord : UNISIGNED16
	0x02	UNISIGNED32	0x47010010	ActualMotionIndex : UNISIGNED16
	0x03	UNISIGNED32	0x60640020	ActualPosition : INTEGER32
	0x04	UNISIGNED32	0x606C0020	ActualVelocity : INTEGER32
	0x05	UNISIGNED32	0x60770010	ActualTorque : INTEGER16
	0x06	UNISIGNED32	0x60FD0020	DigitalInput : UNISIGNED32

6.2.29 0x1C00 : Sync Manager Communication Type

Preconfigured read-only object is used to read the EtherCAT sync manager channel transfer mode.

Name	Sync Manager Communication Type
Index	0x1C00
Data Type	RECORD
Number of Entries	8

6.2.29.1 Number of used SYNC manager channels

Name	Number of used SYNC manager channels
Index	0x1C00
Sub Index	0x00
Data Type	UNISIGNED8
Access Type	RO
Unit	Number
Default Value	8
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.29.2 Communication Type Sync Manager Channel 0

Name	Communication Type Sync Manager Channel 0
Index	0x1C00
Sub Index	0x01
Data Type	UNISIGNED8
Access Type	RO
Unit	Number
Default Value	0x01 : Mailbox Receive (Master -> Slave)
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.29.3 Communication Type Sync Manager Channel 1

Name	Communication Type Sync Manager Channel 1
Index	0x1C00
Sub Index	0x02
Data Type	UNISIGNED8
Access Type	RO
Unit	Number
Default Value	0x02 : Mailbox Transmit (Slave → Master)
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.29.4 Communication Type Sync Manager Channel 2

Name	Communication Type Sync Manager Channel 2
Index	0x1C00
Sub Index	0x03
Data Type	UNISIGNED8
Access Type	RO
Unit	Number
Default Value	0x03 : Process Data output (Master → Slave)
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.29.5 Communication Type Sync Manager Channel 3

Name	Communication Type Sync Manager Channel 3
Index	0x1C00
Sub Index	0x04
Data Type	UNISIGNED8
Access Type	RO
Unit	Number
Default Value	0x04 : Process Data Input (Slave → Master)
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.29.6 Communication Type Sync Manager Channel 4 ~ 7

Name	Communication Type Sync Manager Channel 4 ~ 7
Index	0x1C00
Sub Index	0x05 ~ 0x08
Data Type	UNISIGNED8
Access Type	RO
Unit	Number
Default Value	0x00
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.30 0x1C12 : Sync Manager Ch2

This object indicates the configuration of PDO assignment for the Sync Manager Ch2 (Master → Slave).

In order to change the object value, the Number of Assigned RxPDOs must be set to 0 first.

Write access is only allowed in the [Pre-Operational] NMT state.

Name	Sync Manager Ch2
Index	0x1C12
Data Type	RECORD
Number of Entries	1

6.2.30.1 Number of assigned PDOs on Sync Manager Ch2

Name	Number of assigned PDOs on Sync Manager Ch2	
Index	0x1C12	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	-	
Default Value	1	
Value Range	1	1
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	EtherCAT	

6.2.30.2 PDO Mapping Object assigned RxPDO

Name	PDO Mapping Object assigned RxPDO	
Index	0x1C12	
Sub Index	0x01	
Data Type	UNISIGNED16	
Access Type	RW	
Unit	-	
Default Value	0x1608	
Value Range	0x1600	0x1609
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	EtherCAT	

6.2.31 0x1C13 : Sync Manager Ch3

This object indicates the configuration of PDO assignment for the Sync Manager Ch3 (master → slave).

In order to change the value of the assigned TxPDO object, the Number of assigned TxPDOs must be set to 0 first.

Write access is only allowed in the [Pre-Operational] NMT state.

Name	Sync Manager Ch3
Index	0x1C13
Data Type	RECORD
Number of Entries	1

6.2.31.1 Number of assigned PDOs on Sync Manager Ch3

Name	Number of assigned PDOs on Sync Manager Ch3
Index	0x1C13
Sub Index	0x00
Data Type	UNISIGNED8
Access Type	RW
Unit	-
Default Value	1
Value Range	1 1
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.31.2 PDO Mapping Object assigned TxPDO

Name	PDO Mapping Object assigned TxPDO
Index	0x1C13
Sub Index	0x01
Data Type	UNISIGNED16
Access Type	RW
Unit	-
Default Value	0x1A08
Value Range	0x1A00 0x1A08
PDO Mapping	NO
Backup	NO
Fieldbus Type	EtherCAT

6.2.32 0x1FFF : Firmware Download Parameters

This object is used to update the firmware via SDO Communication.

(Manufacturer request)

Name	Firmware Download Parameters
Index	0x1FFF
Data Type	RECORD
Number of Entries	5

Subindex	Name	Data Type	Access	PDO Mapping	Value Range	Default Value
0x00	Number of entries	UINT8	RO	No	UINT8	5
0x01	Firmware Download Key	UINT32	RW	No	UINT32	0
0x02	Firmware Download Command	UINT8	RW	No	UINT8	0
0x03	Firmware Download Status	UINT16	RO	No	UINT16	0
0x04	Firmware Download Data Size	UINT32	RW	No	UINT32	0
0x05	Firmware Download Data	UINT32	RW	No	UINT32	0

6.2.33 0x4000 : Resistance

This object indicates the resistance value of motor.

Name	Resistance	
Index	0x4000	
Sub Index	0x00	
Data Type	UNISIGNED16	
Access Type	RW	
Unit	mΩ	
Default Value	500	
Value Range	1	65535
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.34 0x4001 : Inductance (Q-Axis Inductance)

This object indicates the Inductance value of motor.

Name	Inductance (Q-Axis Inductance)	
Index	0x4001	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	μH	
Default Value	500	
Value Range	1	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.35 0x4002 : D-Axis Inductance

Name	D-Axis Inductance	
Index	0x4002	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	μH	
Default Value	500	
Value Range	1	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.36 0x4003 : Torque Constant

This object indicates the torque constant of motor.

Name	Torque Constant	
Index	0x4003	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Revolute: uNm/A	Linear: uN/A
Default Value	75000	
Value Range	1	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.37 0x4004 : Back-EMF Constant

Name	Back-EMF Constant	
Index	0x4004	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Revolute: uV/(rad/s)	Linear: uV/(m/s)
Default Value	75000	
Value Range	1	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.38 0x4005 : System Inertial

Name	System Inertial	
Index	0x4005	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Revolute: mg • cm ²	Linear: ug
Default Value	100000	
Value Range	1	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.39 0x4006 : Coulomb (Static) Friction

Name	Coulomb (Static) Friction	
Index	0x4006	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Revolute: uNm	Linear: uN
Default Value	0	
Value Range	0	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.40 0x4007 : Viscos Friction

Name	Viscos Friction	
Index	0x4007	
Sub Index	0x00	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	Revolute: uNm/(rad/s)	Linear: uN(m/s)
Default Value	0	
Value Range	0	4294967296
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.41 0x4008 : Position Sensor Type

This object indicates the types of position sensors.

Name	Position Sensor Type	
Index	0x4008	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	-	-
Default Value	0	
Value Range	See table below	
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

Value	Description
0x00	Incremental Encoder
0x02	Hall Sensor
0x03	Incremental Encoder & Hall Sensor

6.2.42 0x4009 : Position Sensor Polarity

Name	Position Sensor Polarity	
Index	0x4009	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	-	-
Default Value	0	
Value Range	See table below	
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

Bit	Description
0	Position Encoder Polarity Inverted
1	Hall Sensor Polarity Inverted
2	Hall Sensor Bit Polarity Inverted
3	Electrical Angle Polarity Inverted
4	Reserved
5	Reserved
6	Reserved
7	Reserved

6.2.43 0x400A : Hall Sensor Pole Pair

Name	Hall Sensor Pole Pair	
Index	0x400A	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RW	
Unit	Number	
Default Value	0	
Value Range	0	255
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.44 0x4080 : Error History

This object contains information on the Error History.

Name	Error History
Index	0x4080
Data Type	RECORD
Number of Entries	0~10

6.2.44.1 Number of entries

This object indicates the number of errors in the Error History.

By writing the value “0” to subindex 0x00 of the Error History (0x4080), the Error History can be cleared.

Name	Number of entries
Index	0x4080
Sub Index	0x00
Data Type	UNISIGNED8
Access Type	RW
Unit	-
Default Value	0
Value Range	0 10
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.44.2 Error Code

This object contains the latest error information.

CiA 402 Error Codes (0x603F) can be sequentially stored up to 10 in the subindex.

Name	Error Code 0~10
Index	0x4080
Sub Index	0x01 ~ 0x0A
Data Type	UNISIGNED16
Access Type	RO
Unit	-
Default Value	0
Value Range	See Error Code (0x603F) -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.45 0x4100 : Motor Phase

Name	Motor Phase
Index	0x4100
Sub Index	0x00
Data Type	UNISIGNED16
Access Type	RW
Unit	-
Default Value	0
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	PWM 123 → Motor UVW
1	PWM 123 → Motor UWV
2	PWM 123 → Motor VUW
3	PWM 123 → Motor VWU
4	PWM 123 → Motor WUV
5	PWM 123 → Motor WVU

6.2.46 0x4101 : Electric Angel Offset

Name	Electric Angel Offset
Index	0x4101
Sub Index	0x00
Data Type	UNISIGNED16
Access Type	RW
Unit	degree*10 ⁻¹
Default Value	0
Value Range	-3600 3600
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.47 0x4107 : Hall Sensor Pattern

Name	Hall Sensor Pattern	
Index	0x4107	
Sub Index	0x00	
Data Type	UNISIGNED8	
Access Type	RO	
Unit	-	
Default Value	-	
Value Range	1	6
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	
Bit	Description	
0	U	
1	V	
2	W	

6.2.48 0x4205 : Current Control Parameter Set

This object Indicates the current control parameter setting.

Name	Current Control Parameter Set	
Index	0x4205	
Data Type	RECORD	
Number of Entries	6	

6.2.48.1 D-Axis Current Controller P-Gain

Name	D-Axis Current Cotroller P-Gain	
Index	0x4205	
Sub Index	0x01	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	1000	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.48.2 D-Axis Current Controller I-Gain

Name	D-Axis Current Cotroller P-Gain	
Index	0x4205	
Sub Index	0x01	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	1000	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.48.3 Q-Axis Current Controller P-Gain

Name	Q-Axis Current Cotroller P-Gain	
Index	0x4205	
Sub Index	0x04	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	1000	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.48.4 Q-Axis Current Controller I-Gain

Name	Q-Axis Current Cotroller I-Gain	
Index	0x4205	
Sub Index	0x05	
Data Type	UNISIGNED32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	1000	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.49 0x4206 : Current Controller Bandwidth

Name	Current Cotroller Bandwidth	
Index	0x4206	
Sub Index	0x00	
Data Type	UNISIGNED16	
Access Type	RW	
Unit	Hz	
Default Value	2000	
Value Range	1000	10000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.50 0x4207 : Target Current

Name	Target Current	
Index	0x4207	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	mA	
Default Value	0	
Value Range	-Motor Rated Current	+Motor Rated Current
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.51 0x4208 : Actual Current

This object Indicates the value of the motor's actual current.

Name	Actual Current	
Index	0x4208	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	mA	
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.52 0x4209 : Averaged Current (Moving Averaged 10step)

This object Indicates the average value of the motor's actual current

Name	Averaged Current (Moving Averaged 10step)	
Index	0x4209	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	mA	
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.53 0x4300 : Velocity Control Parameter Set

Speed control is performed by the digital PI controller. This object retains all parameters of the speed controller.

Name	Velocity Control Parameter Set	
Index	0x4300	
Data Type	RECORD	
Number of Entries	5	

6.2.53.1 Velocity Controller P-Gain

This object Indicates the proportional gain of speed controller.

Name	Velocity Controller P-Gain	
Index	0x4300	
Sub Index	0x01	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	10 ⁻⁶	
Default Value	100	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.53.2 Velocity Controller I-Gain

This object Indicates the integral gain of speed controller.

Name	Velocity Controller I-Gain	
Index	0x4300	
Sub Index	0x02	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	100	
Value Range	0	1000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.53.3 Velocity Feed-Forward Gain

This object Indicates the speed feed-forward gain of speed controller.

Name	Velocity Feed-Forward Gain	
Index	0x4300	
Sub Index	0x04	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	%	
Default Value	50	
Value Range	0	250
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.53.4 Acceleration Feed-Forward Gain

This object Indicates the acceleration feed-forward gain of speed controller.

Name	Acceleration Feed-Forward Gain	
Index	0x4300	
Sub Index	0x05	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	%	
Default Value	50	
Value Range	0	250
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.54 0x4301 : Velocity Control Bandwidth

This object Indicates the bandwidth of speed controller.

Name	Velocity Controller Bandwidth	
Index	0x4301	
Sub Index	0x00	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	Hz	
Default Value	200	
Value Range	1	2000-
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.55 0x4302 : I2T Over Load Protection

This object indicates the current limiting function for device protection in case of overcurrent.

Name	I2T Over Load Protection	
Index	0x4302	
Data Type	RECORD	
Number of Entries	5	

6.2.55.1 I2T Mode

This object indicates the current limiting in case of overcurrent.

Name	I2T Mode
Index	0x4302
Sub Index	0x01
Data Type	UNSIGNED8
Access Type	RW
Unit	Number
Default Value	0
Value Range	- -
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	I2T Over Load Fault
1	I2T Over Load Limit Rated Current

6.2.55.2 Max. Current

Name	Max Current
Index	0x4302
Sub Index	0x02
Data Type	UNSIGNED32
Access Type	RO
Unit	mA
Default Value	2
Value Range	
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Max current values are as follows.

Max Current [mA] = Rated Current [mA] x Max. Current [0.1%]/ 10

Rated Current: 0x6075

Max. Current: 0x6073

6.2.55.3 Over Load Duration Time

With the I2T mode disabled, an overcurrent error occurs if the peak exceeds the duration time.

Name	Over Load Duration Time
Index	0x4302
Sub Index	0x03
Data Type	UNSIGNED16
Access Type	RW
Unit	msec
Default Value	1000
Value Range	0~5000
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.55.4 I2T Energy Setpoint Value

Name	I2T Energy Setpoint Value
Index	0x4302
Sub Index	0x04
Data Type	UNSIGNED32
Access Type	RO
Unit	A ² x msec
Default Value	0
Value Range	I2T Energy Setpoint = $(I_p^2 - I_c^2) \times T$ (duration Time)
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.55.5 I2T Energy Actual Value

Name	I2T Energy Actual Value
Index	0x4302
Sub Index	0x05
Data Type	UNSIGNED32
Access Type	RO
Unit	A ² x msec
Default Value	0
Value Range	I2T Energy Actual = Integral (I _o ² - I _c ²) x dT
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.56 0x4310 : Velocity Kalman Filter Covariance

Name	Velocity kalman Filter Covariance
Index	0x4310
Sub Index	0x00
Data Type	UNSIGNED32
Access Type	RW
Unit	10 ⁻³
Default Value	500
Value Range	1 1000
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.57 0x4311 : External Load Torque Feed-Forward Gain

Name	External Load Torque Feed-Forward Gain
Index	0x4311
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RW
Unit	%
Default Value	50
Value Range	0 100
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.58 0x4312 : External Load Torque Deadzone

Name	External Load Torque Deadzone	
Index	0x4312	
Sub Index	0x00	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	%	
Default Value	5	
Value Range	0	100
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.59 0x4313 : Load Torque

Name	Load Torque	
Index	0x4313	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	Revolute: mNm	Linear : mN
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.60 0x4314 : Load Torque Threshold

Name	Load Torque Threshold	
Index	0x4314	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: mNm	Linear : mN
Default Value	0	
Value Range	0	2147483647
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.61 0x4321 : Velocity Auto-Tuning Acceleration

This object indicates the acceleration of the motor driven in the speed auto-tuning process.

Name	Velocity Auto-Tuning Acceleration	
Index	0x4321	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear : mm/s ²
Default Value	1000	
Value Range	1000	Maximum Acceleration(0x60C5)
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.62 0x4322 : Velocity Auto-Tuning Velocity

This object indicates the velocity of the motor driven in the speed auto-tuning process.

Name	Velocity Auto-Tuning Velocity	
Index	0x4322	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear : mm/s
Default Value	500	
Value Range	1	Maximum Profile Velocity (0x607F)
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.63 0x4323 : Velocity Auto-Tuning Position

This object indicates the position of the motor driven in the speed auto-tuning process. The motor is driven by the position data value, and auto-tuning is performed.

Name	Velocity Auto-Tuning Position	
Index	0x4323	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	Count	
Default Value	500	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.64 0x4400 : Position Control Parameter Set

This object retains the parameters of position controller. The position controller is implemented in the digital PID controller.

Name	Position Control Parameter Set	
Index	0x4400	
Data Type	RECORD	
Number of Entries	3	

6.2.64.1 Position Controller P-Gain

This object indicates the proportional gain of the position controller.

Name	Position Controller P-Gain	
Index	0x4400	
Sub Index	0x01	
Data Type	INTEGER32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	30000	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.64.2 Position Controller I-Gain

This object indicates the integral gain of the position controller.

Name	Position Controller I-Gain	
Index	0x4400	
Sub Index	0x02	
Data Type	INTEGER32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	0	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.64.3 Position Controller D-Gain

This object indicates the differential gain of the position controller.

Name	Position Controller D-Gain	
Index	0x4400	
Sub Index	0x03	
Data Type	INTEGER32	
Access Type	RW	
Unit	10 ⁻³	
Default Value	0	
Value Range	0	1000000000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.65 0x4500 : Current Threshold for Homing Mode

This object is used for the Homing Method in which homing is performed by Stopper in the Homing Mode. The stopper is detected when the output current exceeds the Current threshold for homing mode value (0x4500).

6.2.66 0x4600 : Temperature

Name	Temperature
Index	0x4600
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RO
Unit	°C
Default Value	-
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.67 0x4601 : Regenerator Clamp Cut-off Voltage

Name	Regenerator Clamp Cut-off Voltage
Index	0x4601
Sub Index	0x00
Data Type	UNSIGNED16
Access Type	RW
Unit	V
Default Value	60
Value Range	- -
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.68 0x4610 : Brake Parameters

Brake is designed to prevent inadvertent drifting when the device has stopped operating. It is enabled when no torque is applied to the motor. When the controller applies torque to the motor, the brake is disabled. The function can be mapped to digital output. Therefore, the output current limiting must be taken into consideration.

Name	Brake Parameters
Index	0x4610
Data Type	RECORD
Number of Entries	7

6.2.68.1 Brake Type

Name	Brake Type
Index	0x4610
Sub Index	0x01
Data Type	UNSIGNED8
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	None
1	Digital Output bit 0
2	Voltage Control

6.2.68.2 Brake Polarity

This object indicates the polarity of the brake.

Name	Brake Polarity
Index	0x4610
Sub Index	0x02
Data Type	UNSIGNED8
Access Type	RW
Unit	Number
Default Value	0
Value Range	0 : None inverting 1 : Inverting
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.68.3 Brake On Delay Time

This object indicates the time taken to reach a braking torque after the power is turned off. The value is displayed in [ms].

Name	Brake On Delay Time	
Index	0x4610	
Sub Index	0x03	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	ms	
Default Value	0	
Value Range	0	10000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.68.4 Brake Off Delay Time

This object indicates the time taken from POWER-ON until the braking torque is released. The value is displayed in [ms].

Name	Brake Off Delay Time	
Index	0x4610	
Sub Index	0x04	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	ms	
Default Value	0	
Value Range	0	10000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.68.5 Min. Motor Speed for Brake On

The brake will be turned on only below the set speed.

Name	Min. Motor Speed for Brake On	
Index	0x4610	
Sub Index	0x05	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	10 ⁻³ RPM	
Default Value	0	
Value Range	10	500
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.68.6 Turn On Voltage

This object indicates the voltage at which the brake is turned on.

Name	Turn On Voltage	
Index	0x4610	
Sub Index	0x06	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	V	
Default Value	12	
Value Range	0	24
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.68.7 On Hold Voltage

This object indicates the voltage at which the brake is held.

Name	On Hold Voltage	
Index	0x4610	
Sub Index	0x07	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	V	
Default Value	0	
Value Range	0	24
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.69 0x4620 : Collision Detection

This object contains the collision detection information.

Name	Collision Detection	
Index	0x4620	
Data Type	RECORD	
Number of Entries	2	

6.2.69.1 Minimum Collision Detection Position

Name	Minimum Collision Detection Position	
Index	0x4620	
Sub Index	0x01	
Data Type	INTEGER32	
Access Type	RW	
Unit	count	
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.69.2 Maximum Collision Detection Position

Name	Maximum Collision Detection Position	
Index	0x4620	
Sub Index	0x02	
Data Type	INTEGER32	
Access Type	RW	
Unit	count	
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.70 0x4700 : Target Motion Info

This object contains the motion command information used in the Motion Sequence Mode (MSM).

Name	Target Motion Info	
Index	0x4700	
Data Type	RECORD	
Number of Entries	8	

6.2.70.1 Target Motion Index

This object is used to enter the index of the first motion to be performed from the motion table.

Name	Target Motion Index	
Index	0x4700	
Sub Index	0x02	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	Number	
Default Value	0x4710	
Value Range	0x4710	0x4719
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.71 0x4701 : Actual Motion Index

This object indicates the current motion index.

Name	Actual Motion Index	
Index	0x4701	
Sub Index	0x00	
Data Type	UNSIGNED16	
Access Type	RO	
Unit	Number	
Default Value	0x4710	
Value Range	0x4710	0x4719
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.72 0x4702 : Motion Error History

This object provides information on the motion error history.

Name	Motion Error History	
Index	0x4702	
Data Type	RECORD	
Number of Entries	0 ~ 10	

6.2.72.1 Number of Motion Error History

This object indicates the number of motion errors in the motion error history. Up to 10 motions errors in the motion error history can be stored.

Name	Number of Motion Error History	
Index	0x4702	
Sub Index	0x00	
Data Type	UNSIGNED8	
Access Type	RO	
Unit	Number	
Default Value	0	
Value Range	0	10
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.72.2 Motion Error 0 ~ 9

This object contains the latest error information. Up to 10 motion errors can be stored sequentially in the subindex.

Name	Motion Error
Index	0x4702
Sub Index	0x01 ~ 0x0A
Data Type	UNSIGNED32
Access Type	RO
Unit	Number
Default Value	-
Value Range	Low Word : Motion Index High Word : Error Code
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.73 0x4710 : Motion 0 ~ 9 (0x4710~0x4719)

This object defines the motion table for motion control. The max number of motions that can be registered with the motion table is 10. The motion objects registered with the indices 0x4710 ~ 0x4719 are composed of subindices 0x01~ 0x0C, and each motion can be set with the subindex data.

Name	Motion 0 ~ 9
Index	0x4710 ~ 0x4719
Data Type	RECORD
Number of Entries	12

6.2.73.1 Number of entries

This object indicates the number of the motion parameters (subindex).

Name	Number of entries
Index	0x4710 ~ 0x4719
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RO
Unit	Number
Default Value	12
Value Range	-
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.73.2 Motion Mode of Operation

This object indicates the operation mode of motion. The information displayed by subindices 0x02~0x06 varies with the modes.

Name	Motion Mode of Operation
Index	0x4710 ~ 0x4719
Sub Index	0x01
Data Type	INTEGER8
Access Type	RW
Unit	Number
Default Value	1
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
6	Homing Mode(HM)
3	Profile Velocity Mode(PVM)
1	Profile Position Mode(PPM)
-10	Torque Regulation Mode(TRM)

Subindex	Profile Position Mode	Profile Velocity Mode	Torque Regulation Mode	Homing Mode
0x01:Motion Mode	1	3	-10	6
0x02:TargetValue	Target Position	Target Velocity	Target Torque	Homing Method
0x03:parameter0	Profile Velocity	Profile Acceleration	-	Switch Search Velocity
0x04:parameter1	Profile Acceleration	Profile Deceleration	-	Zero Search Velocity
0x05:parameter2	Profile Deceleration	-	-	Homing Acceleration
0x06:parameter3	Profile Jerk	-	-	Home Offset

6.2.73.3 Motion Target

Motion Target refers to the target value depending on the operation modes. If subindex 0x01(Motion Mode of Operation) is in the Homing Mode, then the object indicates the Homing Method.

Name	Motion Target
Index	0x4710 ~ 0x4719
Sub Index	0x02
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Motion Mode (subindex 0x01)	Data	Description
Homing Mode(HM)	Homing Method	See Homing Method (0x6098)
Profile Velocity Mode(PVM)	Target Velocity	See Target Velocity (0x60FF)
Profile Position Mode(PPM)	Target Position	See Target Position (0x607A)
Torque Regulation Mode(TRM)	Target Torque	See Target Torque (0x6071)

6.2.73.4 Motion Parameter 0

This object indicates a motion parameter. The parameter information varies with the motion modes (subindex 0x01).

Name	Motion Parameter 0
Index	0x4710 ~ 0x4719
Sub Index	0x03
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Motion Mode (subindex 0x01)	Motion Parameter 0	Description
Homing Mode(HM)	Switch Search Velocity	See Homing Method (0x6098)
Profile Velocity Mode(PVM)	Profile Acceleration	See Profile Acceleration (0x6083)
Profile Position Mode(PPM)	Profile Velocity	See Profile Velocity (0x6081)
Torque Regulation Mode(TRM)	-	-

6.2.73.5 Motion Parameter 1

This object indicates a motion parameter. The parameter information varies depending on the motion modes (subindex 0x01).

Name	Motion Parameter 1
Index	0x4710 ~ 0x4719
Sub Index	0x04
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Motion Mode (subindex 0x01)	Motion Parameter 0	Description
Homing Mode(HM)	Zero Search Velocity	See Homing Speeds(0x6099)
Profile Velocity Mode(PVM)	Profile Deceleration	See Profile Deceleration(0x6084)
Profile Position Mode(PPM)	Profile Acceleration	See Profile Acceleration (0x6083)
Torque Regulation Mode(TRM)	-	-

6.2.73.6 Motion Parameter 2

This object indicates a motion parameter. The parameter information varies depending on the motion modes (subindex 0x01).

Name	Motion Parameter 2
Index	0x4710 ~ 0x4719
Sub Index	0x05
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Motion Mode (subindex 0x01)	Motion Parameter 2	Description
Homing Mode(HM)	Homing Acceleration	See Homing Acceleration(0x609A)
Profile Velocity Mode(PVM)	-	
Profile Position Mode(PPM)	Profile Deceleration	See Profile Deceleration(0x6084)
Torque Regulation Mode(TRM)	-	-

6.2.73.7 Motion Parameter 3

This object indicates a motion parameter. The parameter information varies with the motion modes (subindex 0x01).

Name	Motion Parameter 3
Index	0x4710 ~ 0x4719
Sub Index	0x06
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Motion Mode (subindex 0x01)	Motion Parameter 3	Description
Homing Mode(HM)	Homing Offset	See Homing Offset (0x607C)
Profile Velocity Mode(PVM)	-	-
Profile Position Mode(PPM)	Profile Jerk	See Profile Jerk(0x60A4)
Torque Regulation Mode(TRM)	-	-

6.2.73.8 Condition Type of Next Motion-A

This object is used to set the types of conditions for automatic execution in the next motion.

Value	Name	Description
0	None	No execution on next motion
1	Target Reached	Execute next motion after completing current motion
2	Target Reached and Wait	Upon completion of current motion, standby for next motion during the time specified in subindex 0x08
3	Less than position	Execute next motion if current position value is smaller than the one specified in subindex 0x08
4	More than position	Execute next motion if current position value is greater than the one specified in subindex 0x08
5	Duration	After completing the current motion, standby for next motion during the time specified in subindex 0x08
6	External Load Torque/Force	Execute next motion if external load is greater than the value specified in subindex 0x08
7	Digital Input	Execute next motion if data received via digital input port has the same value as the one specified in subindex 0x08

6.2.73.9 Condition Value of Next Motion-A

This object is used to set the conditions for automatic execution in the next motion. It sets the data corresponding to the condition type specified in the subindex (Condition Type of Next Motion-A).

Name	Condition Value of Next Motion-A
Index	0x4710 ~ 0x4719
Sub Index	0x08
Data Type	INTEGER32
Access Type	RW
Unit	See table below
Default Value	0
Value Range	-
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Subindex 0x07	Unit
0	Ignored
1	Ignored
2	msec
3	Count
4	Count
5	msec
6	Revolute : mNm, Linear: mN
7	Digital Input State

6.2.73.10 Index of Next Motion-A

This object sets the motion to be performed when the condition specified in subindices 0x06 and 0x07 is met.

Name	Index of Next Motion-A
Index	0x4710 ~ 0x4719
Sub Index	0x09
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0x0000	Motion Complete
0x0001	Quick Stop
0x0002	Disable Operation
0x0003	Shutdown
0x4710 ~ 0x4719	Next Motion Index
Other value	Motion Complete

6.2.73.11 Condition Type of Next Motion-B

This object sets the second condition for automatic execution of the next motion.

Name	Condition Type of Next Motion-B
Index	0x4710 ~ 0x4719
Sub Index	0x0A
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.73.12 Condition Value of Next Motion-B

This object sets the second condition for automatic execution in the next motion. The data is set to meet the condition specified in the subindex 0x0A (Condition Type of Next Motion-A).

Name	Condition Value of Next Motion-B
Index	0x4710 ~ 0x4719
Sub Index	0x0B
Data Type	INTEGER32
Access Type	RW
Unit	See table below
Default Value	0
Value Range	-
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Subindex 0x0A	Unit
0	None
1	Target Reached
2	Target Reached and Wait
3	Less than position
4	More than position
5	Duration
6	External Load Torque/Force
7	Digital Input

6.2.73.13 Index of Next Motion-B

This object sets the motion to be performed when the condition specified in subindices 0x0A and 0x0B is met.

Name	Index of Next Motion-B
Index	0x4710 ~ 0x4719
Sub Index	0x0C
Data Type	INTEGER32
Access Type	RW
Unit	Number
Default Value	0
Value Range	See the table
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0x0000	Motion Complete
0x0001	Quick Stop
0x0002	Disable Operation
0x0003	Shutdown
0x4710 ~ 0x4719	Next Motion Index
Other value	Motion Complete

6.2.74 0x5000 : ID for CAN, UART

This object identifies the CANopen node.

Any changes to this object will not take effect until a restart.

Name	ID for CAN, UART
Index	0x5000
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RW
Unit	Number
Default Value	1
Value Range	1 127
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen

6.2.75 0x5001 : UART Baudrate

This object sets the bit rate of serial communication interface.

Any changes to this object will not take effect until a restart. Therefore, make changes and save all parameters before restarting.

Name	UART Baudrate
Index	0x5001
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RW
Unit	Number
Default Value	4
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen

Value	Description
0	None
1	9,600 bps
2	19,200 bps
3	38,400 bps
4	57,600 bps
5	115,200 bps
6	230,400 bps
7	460,800 bps
8	921,600 bps

6.2.76 0x5002 : CAN Bitrate

This object retains the desired bit rate of the CAN interface.

Any changes to this object will not take effect until a restart. Therefore, make changes and save all parameters before restarting.

Name	CAN Bitrate
Index	0x5002
Sub Index	0x00
Data Type	UNSIGNED8
Access Type	RW
Unit	Number
Default Value	5
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen

Value	Description
0	None
1	10 kbps (Not supported)
2	20 kbps
3	50 kbps
4	125 kbps
5	250 kbps
6	500 kbps
7	800 kbps(Not supported)
8	1 Mkbps

6.2.77 0x5010 : Analog Input

Name	Analog Input
Index	0x5010
Data Type	RECORD
Number of Entries	4

6.2.77.1 Analog Input 0 ~ 3

This object indicates the analog input value for each channel 0~3.

Name	Analog Input 0 ~ 3	
Index	0x5010	
Sub Index	0x01 ~ 0x04	
Data Type	UNSIGNED16	
Access Type	RO	
Unit	Value	
Default Value	-	
Value Range	0	65535
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.78 0x6007 : Abort Connection Option Code

This object specifies the motion to be performed when an error is detected. This includes all communication errors.

Some serious errors will always generate Disable command regardless of predefined settings.

Related objects: Error Resister(0x1001), Fault Reaction Option Code (0x605E)

Name	Abort Connection Option Code	
Index	0x6007	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RW	
Unit	-	
Default Value	0	
Value Range	-	-
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

Value	Description
0	No Action
1	Reserved
2	Disable Voltage Command
3	Quick Stop Command
4 ~ 32767	Reserved

6.2.79 0x603F : Error Code

This object provides the error code for the last error that occurred on the device.

This object differs from the value of the object "Error Register (0x1001)." This value is the one that will appear in the object "Error History (0x4080)."

Name	Error Code
Index	0x603F
Sub Index	0x00
Data Type	UNSIGNED16
Access Type	RO
Unit	-
Default Value	0x0000
Value Range	See table below -
PDO Mapping	TxPDO MAPPING
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Value	Description	Error Register
0x1000	Generic Error	0000 0001
0x2310	Over Current Error	0000 0010
0x3210	Over Voltage Error	0000 0100
0x3220	Under Voltage Error	0000 0100
0x4210	Over Temperature Error	0000 1000
0x5210	Current Detection Error	0000 0001
0x6100	Internal Software Error	0010 0000
0x7300	Serial Encoder Communication Error	0000 0001
0x7305	Encoder Disconnection Error	0000 0001
0x7310	Over Speed Error	0010 0000
0x8400	Maximum Velocity Error Fault	0000 0001
0x8611	Following Error	0010 0000
0xFF01	Hall Sensor Error	1000 0000
0xFF02	Over Load Error	0010 0000

6.2.80 0x6040 : Controlword

The drive control command is triggered by the next bit patten of the Controlword.


Related object: Statusword(0x6041)

Name	Controlword
Index	0x6040
Sub Index	0x00
Data Type	UNSIGNED16
Access Type	RW
Unit	-
Default Value	-
Value Range	-
PDO Mapping	RxPDO MAPPING
Backup	NO
Fieldbus Type	CANopen, EtherCAT

- Data bit description

Bit	Description
0	Switch On
1	Enable Voltage
2	Quick Stop
3	Enable Operation
4	Operation Mode Specific (New Setpoint/ Start Homing/ Start Motion Sequence)
5	Change set immediately
6	Absolute(0)/Relative(1)
7	Fault Reset
8	Halt
9	Operation Mode Specific
10	Reserved
11	Manufacturer Specific
12	Manufacturer Specific
13	Manufacturer Specific
14	Manufacturer Specific
15	Manufacturer Specific

- Device Control Command Triggers (Bits 0 ~ 3 and 7)

Bit	Bits of the controlword					Transitions
	7	3	2	1	0	
	Fault Reset	Enable Operation	Quick Stop	Enable Voltage	Switch on	
Shutdown	0	X	1	1	0	2, 6, 8
Switch ON	0	0	1	1	1	3*
Switch ON	0	1	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		X	X	X	X	15

- The bits marked with X are irrelevant.
- *the drive performs SWITCH_ON function.
- **the drive does nothing in this state and is treated the same as *.

Command	LowByte of Controlword [binary]	State transition
Shutdown	0xxx x110	2,6,8
Switch On	0xxx x111	3
Disable Voltage	0xxx xx0x	7,9,10,12
Quick Stop	0xxx x01x	7,10,11
Disable Operation	0xxx 0111	5
Enable Operation	0xxx 1111	4,16
Fault Reset	0xxx xxxx →1xxx xxxx	14, 15

- Controlword and Operation Modes

Bit	Description	Mode of Operation										
		CST	CSV	CSP	HM	PVM	PPM	CRM	TRM	VRM	PRM	MSM
0	Switch On	0	0	0	0	0	0	0	0	0	0	0
1	Enable Voltage	0	0	0	0	0	0	0	0	0	0	0
2	Quick Stop	0	0	0	0	0	0	0	0	0	0	0
3	Enable Operation	0	0	0	0	0	0	0	0	0	0	0
4	New Setpoint	X	X	X	X	X	0	X	X	X	X	X
	Start Homing	X	X	X	0	X	X	X	X	X	X	X
	Start Motion Sequence	X	X	X	X	X	X	X	X	X	X	0
5	Change set immediately	X	X	X	X	X	0	X	X	X	X	X
6	Absolute(0)/Relative(1)	X	X	X	X	X	0	X	X	X	X	X
7	Fault Reset	0	0	0	0	0	0	0	0	0	0	0
8	Halt	0	0	0	0	0	0	0	0	0	0	0
9	Operation Mode Specific	-	-	-	-	-	-	-	-	-	-	-
10	Reserved	-	-	-	-	-	-	-	-	-	-	-
11~15	Manufacturer Specific	-	-	-	-	-	-	-	-	-	-	-

- See Mode of Operation for more details of Bit 4...6,8

6.2.81 0x6041 : Statusword

This object indicates the current status of the drive.

Related object: Controlword(0x6040)

Name	Statusword
Index	0x6041
Sub Index	0x00
Data Type	UNSIGNED16
Access Type	RO
Unit	-
Default Value	-
Value Range	
PDO Mapping	TxPDO MAPPING
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Bit	Description	Note
0	Ready to switch on	
1	Switched on	
2	Operation enable	
3	Fault	
4	Voltage enabled	Bits 0 - 3, 5 and 6: Indicate the current status of drive
5	Quick stop	With this bit set to 1, High Voltage will be applied to the drive.
6	Switch on disable	When reset, this bit indicates that the drive is responding to Quick Stop request. Statusword bits 0, 1 and 2 must be set to 1 to indicate the drive can be regenerated. The setting of other bits indicates the drive status. (e.g. the drive is performing Quick Stop in response to a nonfatal error. The Fault bit is set other than to 0, 1, and 2.)
7	Warning	Bits 0 - 3, 5 and 6: indicate the current status of drive
8	Manufacturer specific	If Bit 7 is set, this displays a drive warning. This state must be displayed even when there is no error. For example, a task is rejected. The drive status does not change. The cause of this warning can be found by reading the Fault Code parameter. This bit is set when an illegal control word is received and at least one Statusword of this transition is sent before a reset.
9	Remote	Load Torque Threshold Reached
10	Target reached	If Bit 9 is set, parameters can be modified via the CAN network, and the drive executes the contents of a command message. With bit remote being reset, the drive will be in local mode and will not execute a command. The drive can transmit messages containing a valid value such as the position actual value based on actual drive configuration. The drive allows access via SDO in local mode.
11	Internal limit active	Bit 10 is set to indicate that the setpoint is reached by the drive. The setpoint varies with the modes of operation. This bit changes if the target value is modified with software.
12	Operation mode specific	With the Quick Stop option code being set to 5 or 6, this bit is set when the Quick Stop task is completed and the drive is stopped.
13	Operation mode specific	This bit is also set when Halt occurs and the drive stops operating. (Target reached, Homing Complete)
14	Manufacturer specific	This bit varies depending on the modes of operation. (Set Point Acknowledge, Homing Attained)
15	Manufacturer specific	This bit varies depending on the modes of operation. (Following Error, Homing Error, Motion Sequence Error)
		Motion Attained: indicates sequential motion has been started.
		Motion Complete: indicates that sequential motion has been completed.

- State

State	Statusword [binary]	Description
Not Ready to Switch On	xxxx xxxx x0xx 0000	Initialization state after control power on Drive function is disabled
Switch On Disabled	xxxx xxxx x1xx 0000	Drive initialization is completed No main power is available Drive function is disabled
Ready to Switch On	xxxx xxxx x01x 0001	Main power is available Drive function is disabled
Switched On	xxxx xxxx x01x 0011	Main power is ON Current offset compensation is completed Drive function is disabled
Operation Enable	xxxx xxxx x01x 0111	There is no error, and the drive function is enabled Servo ON state with power being applied onto the motor
Quick Stop Active	xxxx xxxx x00x 0111	Quick stop is running Drive function is enabled Motor is receiving power
Fault Reaction Active	xxxx xxxx x0xx 1111	Drive error occurs, and the relevant sequences are handled
Fault	xxxx xxxx x0xx 1000	Drive error occurs Drive function is disabled

- Statusword and the Modes of Operating

Bit	Description	Mode of Operation										
		CST	CSV	CSP	HM	PVM	PPM	CRM	TRM	VRM	PRM	MSM
0	Ready to switch on	0	0	0	0	0	0	0	0	0	0	0
1	Switched on	0	0	0	0	0	0	0	0	0	0	0
2	Operation enable	0	0	0	0	0	0	0	0	0	0	0
3	Fault	0	0	0	0	0	0	0	0	0	0	0
4	Voltage enabled	0	0	0	0	0	0	0	0	0	0	0
5	Quick stop	0	0	0	0	0	0	0	0	0	0	0
6	Switch on disable	0	0	0	0	0	0	0	0	0	0	0
7	Warning	0	0	0	0	0	0	0	0	0	0	0
8	Load Torque Threshold Reached	X	0	0	0	0	0	X	0	0	0	0
9	Remote	0	0	0	0	0	0	0	0	0	0	0
10	Target reached	X	X	X	X	0	0	X	X	X	X	X
	Homing Complete	X	X	X	0	X	X	X	X	X	X	X
11	Internal limit active											
12	Set Point Acknowledge	X	X	X	X	X	0	X	X	X	X	X
	Drive follows command value	0	0	0	X	X	X	X	X	X	X	X
	Homing Attained	X	X	X	0	X	X	X	X	X	X	X
13	Following Error	X	X	0	X	X	0	X	X	X	X	X
	Homing Error	X	X	X	0	X	X	X	X	X	X	X
	Motion Sequence Error	X	X	X	X	X	X	X	X	X	X	0
14	Motion Attained	X	X	X	X	X	X	X	X	X	X	0
15	Motion Complete	X	X	X	X	X	X	X	X	X	X	0

See Modes of Operation for more details of Bit 10, 12, and 13.

6.2.82 0x6042 : VL Mode Target Velocity

Name	VL Mode Target Velocity	
Index	0x6042	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RW	
Unit	-	
Default Value	0	
Value Range	0	65535
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.83 0x6043 : VL Mode Demand Velocity

Name	VL Mode Demand Velocity	
Index	0x6043	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RO	
Unit	-	
Default Value	0	
Value Range	0	65535
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.84 0x6044 : VL Mode Actual Velocity

Name	VL Mode Actual Velocity	
Index	0x6044	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RO	
Unit	-	
Default Value	0	
Value Range	0	65535
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.85 0x6046 : VL Mode Velocity Min. Max. Amount

Name	VL Mode Velocity Min. Max. Amount
Index	0x6046
Data Type	RECORD
Number of Entries	2

6.2.85.1 VL Mode Velocity Min. Value

Name	VL Mode Velocity Min. Value	
Index	0x6046	
Sub Index	0x01	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	1	
Value Range	1	Motor Max Speed
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.85.2 VL Mode Velocity Max. Value

Name	VL Mode Velocity Max. Value	
Index	0x6046	
Sub Index	0x02	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	Motor max Spped	
Value Range	1	Motor Max Speed
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.86 0x6048 : VL Mode Velocity Acceleration

Name	VL Mode Velocity Acceleration
Index	0x6048
Data Type	RECORD
Number of Entries	2

6.2.86.1 VL Mode Acceleration Delta Speed

Name	VL Mode Acceleration Delta Speed	
Index	0x6048	
Sub Index	0x01	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	Motor max Sped	
Value Range	1	Motor Max Speed
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.86.2 VL Mode Acceleration Delta Time

Name	VL Mode Acceleration Delta Time	
Index	0x6048	
Sub Index	0x02	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	sec	
Default Value	1	
Value Range	1	65535
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.87 0x6049 : VL Mode Velocity Deceleration

Name	VL Mode Velocity Deceleration
Index	0x6049
Data Type	RECORD
Number of Entries	2

6.2.87.1 VL Mode Deceleration Delta Speed

Name	VL Mode Deceleration Delta Speed	
Index	0x6049	
Sub Index	0x01	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	Motor Max Sped	
Value Range	1	Motor Max Speed
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.87.2 VL Mode Deceleration Delta Time

Name	VL Mode Deceleration Delta Time	
Index	0x6049	
Sub Index	0x02	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	sec	
Default Value	1	
Value Range	1	65535
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.88 0x604A : VL Mode Velocity Quick Stop Deceleration

Name	VL Mode Velocity Quick Stop Deceleration
Index	0x604A
Data Type	RECORD
Number of Entries	2

6.2.88.1 VL Mode Quick Stop Deceleration Delta Speed

Name	VL Mode Quick Stop Deceleration Delta Speed	
Index	0x604A	
Sub Index	0x01	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	Motor Max Sped	
Value Range	1	Motor Max Speed
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.88.2 VL Mode Quick Stop Deceleration Delta Time

Name	VL Mode Quick Stop Deceleration Delta Time	
Index	0x604A	
Sub Index	0x02	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	sec	
Default Value	1	
Value Range	1	65535
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.89 0x605A : Quick Stop Option Code

This object indicates the motion to be performed when Quick Stop is executed.

Name	Quick Stop Option Code
Index	0x605A
Sub Index	0x00
Data Type	INTEGER16
Access Type	RW
Unit	-
Default Value	6
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	Disable Drive Function
1	Slow down on slow-down ramp and then disable the drive
2	Slow down on Quick-stop and then disable the drive
3	Not Supported
4	Not Supported
5	Slow down on slow-down ramp and stay in QUICK-STOP
6	Slow down on Quick-stop and stay in QUICK-STOP
7	Not Supported

6.2.90 0x605B : Shutdown Option Code

This object indicates the motion to be performed during a transition from the [Operation enabled] state to the [Ready to switch on] or [Switch on disabled] state.

Name	Shutdown Option Code
Index	0x605B
Sub Index	0x00
Data Type	INTEGER16
Access Type	RW
Unit	-
Default Value	0
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	Disable Drive Function
1	Slow down on slow-down ramp and then disable the drive
2	Reserved

6.2.91 0x605C : Disable Operation Option Code

This object indicates the motion to be performed during a transition from the [Operation enabled] state to the [Switched on] state.

Name	Disable Operation Option Code
Index	0x605C
Sub Index	0x00
Data Type	INTEGER16
Access Type	RW
Unit	-
Default Value	1
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	Disable Drive Function
1	Slow down on slow-down ramp and then disable the drive
2	Reserved

6.2.92 0x605D : Halt Option Code

This object indicates the motion to be performed when the Halt command is executed.

Name	Halt Option Code
Index	0x605D
Sub Index	0x00
Data Type	INTEGER16
Access Type	RW
Unit	-
Default Value	1
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	Disable Drive Function
1	Slow down on slow-down ramp
2	Slow down on Quick-stop
3	Not Supported
4	Reserved

6.2.93 0x605E : Fault Reaction Option Code

This object specifies the task to be performed when the "Device errors" code is detected. Some critical errors always generate the "Disable" command regardless of predefined settings.

Name	Fault Reaction Option Code
Index	0x605E
Sub Index	0x00
Data Type	INTEGER16
Access Type	RW
Unit	-
Default Value	0
Value Range	
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0	Disable Drive Function
1~4	Not Support

6.2.94 0x6060 : Modes of Operation

This object is used to perform a transition to the Mode of Operation that had actually been selected. It is advised to confirm the changes made to the Mode of Operation by using the object "Modes of Operation Display (0x6061)."

Name	Modes of Operation
Index	0x6060
Sub Index	0x00
Data Type	INTEGER8
Access Type	RW
Unit	-
Default Value	3
Value Range	See table below
PDO Mapping	RxPDO MAPPING
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.95 0x6061 : Modes of Operation Display

This object indicates the actual mode in operation.

Name	Modes of Operation Display
Index	0x6061
Sub Index	0x00
Data Type	INTEGER8
Access Type	RO
Unit	-
Default Value	3
Value Range	Modes of operation (see 0x6060)
PDO Mapping	TxPDO MAPPING
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.96 0x6062 : Position Demand Value

This object is used as input of the position controller. For the profiled motions, the value is generated by the profile generator.

Name	Position Demand Value
Index	0x6062
Sub Index	0x00
Data Type	INTEGER32
Access Type	RO
Unit	count
Default Value	-
Value Range	-2147483648 2147483647
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.97 0x6063 : Internal Position Actual Value

Name	Internal Position Actual Value	
Index	0x6063	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	count	
Default Value	-	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.98 0x6064 : Position Actual Value

This object provides the actual position value of motor, which is measured by a sensor.

- If the sensor is not configured, the Position Actual Value is always “0”.

Name	Position Actual Value	
Index	0x6064	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	count	
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.99 0x6065 : Following Error Window

If the max permissible difference of the "Position Actual value" and the "Position demand value" is exceeded, the Following Errors occur.

Name	Following Error Window	
Index	0x6065	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	count	
Default Value	100000	
Value Range	1	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.100 0x6067 : Position Window

Position Window defines a symmetrical range of acceptable position relative to the Target Position in the Profile Position Mode. If the actual position encoder values are within the Position Window, then the Target Position is considered to have been reached.

Name	Position Window	
Index	0x6067	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	count	
Default Value	5	
Value Range	0	4294967295
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.101 0x6068 : Position Window Time

If the Position actual value remains within the Position Window during the time period specified in the Position window Time, then Bit 10 that indicates “Target Reached” in the Statusword will be set to 1.

Name	Position Window Time	
Index	0x6068	
Sub Index	0x00	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	msec	
Default Value	10	
Value Range	0	65535
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.102 0x606B : Velocity Demand Value

This object is used as input of the speed controller. For the profiled drive, this value is generated by the profile generator.

Name	Velocity Demand Value	
Index	0x606B	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	Revolute: RPM	Linear: mm/s
Default Value	-	
Value Range	-	-
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.103 0x606C : Velocity Actual Value

This object provides the actual velocity value of motor, which is measured by a sensor. If the sensor is not configured, the value is “0”.

Name	Velocity Actual Value	
Index	0x606C	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RO	
Unit	Revolute: RPM	Linear: mm/s
Default Value	-	
Value Range		
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.104 0x606D : Velocity Window

Velocity Window defines the range of acceptable speed relative to the Target Velocity in the Profile Velocity Mode. If the Velocity Actual Value remains within the range of Target Velocity \pm Velocity window, then the Target Velocity is considered to have been reached.

Name	Velocity Window	
Index	0x606D	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	30	
Value Range	0	4294967295
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.105 0x606E : Velocity Window Time

If the Velocity actual value remains within the Velocity Window during the time period specified in the Velocity Window Time, then Bit 10 that indicates “Target Reached” in the Statusword will be set to 1.

Name	Velocity Window Time	
Index	0x606E	
Sub Index	0x00	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	msec	
Default Value	30	
Value Range	0	65535
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.106 0x6071 : Target Torque

This object indicates the input value configured to the torque controller in the Cyclic Synchronous Torque Mode (CST) and the Torque Regulation Mode (TRM). The value is given as 1/1000 of the Motor Rated Torque (0x6076).

Ex) 500 indicates 50% of the rated torque.

Name	Target Torque	
Index	0x6071	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RW	
Unit	0.1%	
Default Value	0	
Value Range	-	-
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.107 0x6072 : Maximum Torque

This object indicates the max output torque.

Ex) 1000 indicates 100% of the Motor Rated Torque (0x6076).

Name	Maximum Torque	
Index	0x6072	
Sub Index	0x00	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	0.1%	
Default Value	1000	
Value Range	1	2000 (Drive dependent value)
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.108 0x6073 : Maximum Current

This object indicates the max output current.

Ex) 2000 indicates 200% of the Motor Rated Current (0x6075).

Name	Maximum Current	
Index	0x6073	
Sub Index	0x00	
Data Type	UNSIGNED16	
Access Type	RW	
Unit	0.1%	
Default Value	2000	
Value Range	1	3000 (Drive dependent value)
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.109 0x6075 : Motor Rated Current

This object indicates the rated current value of motor. This object retains all relative current object values.

Name	Motor Rated Current	
Index	0x6075	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	mA	
Default Value	1000	
Value Range	1	See table below
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

Drive Specification	Value
5A Drive	50,00
10A Drive	10,000
20A Drive	20,000
40A Drive	40,000

6.2.110 0x6076 : Motor Rated Torque

This object indicates the rated torque value of motor. It retains all relative torque object values.

This value is defined as the rated current multiplied by the torque constant.

Name	Motor Rated Torque	
Index	0x6076	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: mNm	Linear: mN
Default Value	0	
Value Range	1	10000000
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.111 0x6077 : Torque Actual Value

This object provides the actual torque value, which is the instant motor torque. The value is displayed in 1/1000 of the Motor Rated Torque.

Name	Torque Actual Value	
Index	0x6077	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RO	
Unit	0.1%	
Default Value		
Value Range	-32768	32767
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.112 0x6078 : Current Actual Value

This object indicates the actual current value of motor. The unit is mA.

Name	Current Actual Value	
Index	0x6078	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RO	
Unit	mA	
Default Value	-	
Value Range	-32768	32767
PDO Mapping	TxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.113 0x6079 : DC Link Circuit Voltage

Name	DC Link Circuit Voltage	
Index	0x6079	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RO	
Unit	mV	
Default Value	-	
Value Range	0	500000
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.114 0x607A : Target Position

This object is used as input of the profile generator for a drive profile. By using the motion control parameters (velocity, acceleration, and deceleration), it indicates the position to which the drive will move.

For the movement without a profile, the target position is used directly as input of the position controller.

No Target Position will be set until the command is given as the Controlword. In this case, the Target Position is interpreted as absolute or relative to the command set in the Controlword. Otherwise, the Target Position will be interpreted as an absolute value.

Name	Target Position	
Index	0x607A	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	Count	
Default Value	-	
Value Range	-2147483648	2147483647
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.115 0x607C : Home Offset

This object indicates the travel distance in the homing process. This object is used to move away from a detected position (e.g. mechanical limit stop or limit switch) at the end of homing sequence, thereby providing motor protection and preventing limit switch errors.

Name	Home Offset	
Index	0x607C	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	Count	
Default Value	-	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.116 0x607D : Software Position Limit

This object defines the min/max position values for the Actual Position value and the Demand Position value. If the Actual Position value and the Demand Position value exceed the limit, an error occurs. In the Profile Position Mode, the new Target Position is limited by the min/max position limiting.

The Software Position Limit is disabled in the Homing Mode (HMM).

Name	Software Position Limit
Index	0x607D
Data Type	RECORD
Number of Entries	2

6.2.116.1 Minimum Software Position Limit

This object defines the min position value for the Actual Position value and the Demand Position value (Absolute Negative Position Limit). If the Actual Position value and the Demand Position value are smaller than the Minimum Software Position Limit, then the Software Position Limit error occurs.

If the Minimum Software Position Limit and Maximum Software Position Limit values equal to "0", then the position limit check is disabled.

Name	Minimum Software Position Limit	
Index	0x607D	
Sub Index	0x01	
Data Type	INTEGER32	
Access Type	RW	
Unit	Count	
Default Value	-	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.116.2 Maximum Software Position Limit

This object defines the max position value for the Actual Position value and the Demand Position value (Absolute Positive Position Limit). If the Actual Position and Demand Position values are greater than the Maximum Software Position Limit, then the Software Position Limit error occurs.

If the Minimum Software Position Limit and Maximum Software Position Limit values equal to "0", then the position limit check is disabled.

Name	Maximum Software Position Limit	
Index	0x607D	
Sub Index	0x02	
Data Type	INTEGER32	
Access Type	RW	
Unit	Count	
Default Value	-	
Value Range	-2147483648	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.117 0x607F : Max. Profile Velocity

This object is used to control the speed in the PPM or PVM drive.

Name	Max Profile Velocity	
Index	0x607F	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	1000	
Value Range	1	Maximum Motor Speed
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.118 0x6080 : Maximum Motor Speed

This object indicates the max permissible speed of motor and provides motor protection. See Motor Specifications

Name	Maximum Motor Speed	
Index	0x6080	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	3000	
Value Range	1	25000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.119 0x6081 : Profile Velocity

This object indicates the speed normally attained at the end of acceleration section during profile motions (PPM, PVM).

Name	Profile Velocity	
Index	0x6081	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	1000	
Value Range	1	Max Profile Velocity
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.120 0x6083 : Profile Acceleration

This object defines the acceleration used for a profile motion.

Name	Profile Acceleration	
Index	0x6083	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	1000	
Value Range	1	Maximum Acceleration
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.121 0x6084 : Profile Deceleration

This object defines the deceleration used for a profile motion.

Name	Profile Deceleration	
Index	0x6084	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	1000	
Value Range	1	Maximum Deceleration
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.122 0x6085 : Quickstop Deceleration

This object, along with the Quick Stop command, is used to determine the deceleration for the Quick Stop profile.

Name	Quick Deceleration	
Index	0x6085	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	1000	
Value Range	1	Maximum Deceleration
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.123 0x6086 : Motion Profile Type

This object selects the types of motion profile trajectory used in the "Profile Position Mode (PPM), Homing Mode (HMM)", Profile Velocity Mode (PVM)."

Name	Motion Profile Type	
Index	0x6086	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RW	
Unit	-	-
Default Value	1	
Value Range	-	-
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

Value	Description
0	Trapezoidal Profile
1	Sinusoidal Profile

6.2.124 0x6089 : Position Notation Index

This object is used to scale the position objects.

Name	Position Notation Index	
Index	0x6089	
Sub Index	0x00	
Data Type	INTEGER8	
Access Type	RW	
Unit	-	-
Default Value	0	
Value Range	0	0
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.125 0x608A : Position Dimension Index

This object is used to scale the position objects.

Name	Position Dimension Index	
Index	0x608A	
Sub Index	0x00	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	-	-
Default Value	0xAC	
Value Range	0xAC	0xAC
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.126 0x608B : Velocity Notation Index

This object is used to scale the velocity objects.

Name	Velocity Notation Index	
Index	0x608B	
Sub Index	0x00	
Data Type	INTEGER8	
Access Type	RW	
Unit	-	-
Default Value	0	
Value Range	0	0
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.127 0x608C : Velocity Dimension Index

This object is used to scale the velocity objects.

Name	Velocity Dimension Index	
Index	0x608C	
Sub Index	0x00	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	-	-
Default Value	0xA4	
Value Range	0xA4	0xA4
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.128 0x608D : Acceleration Notation Index

This object is used to scale the acceleration objects.

Name	Acceleration Notation Index	
Index	0x608D	
Sub Index	0x00	
Data Type	INTEGER8	
Access Type	RW	
Unit	-	-
Default Value	0	
Value Range	0	0
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.129 0x608E : Acceleration Dimension Index

This object is used to scale the acceleration objects.

Name	Acceleration Dimension Index	
Index	0x608E	
Sub Index	0x00	
Data Type	UNSIGNED8	
Access Type	RW	
Unit	-	-
Default Value	0xA4	
Value Range	0xA4	0xA4
PDO Mapping	NO	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.130 0x608F : Position Encoder Resolution

This object indicates the Encoder Resolution.

Name	Position Encoder Resolution
Index	0x608F
Data Type	RECORD
Number of Entries	2

6.2.130.1 Position Encoder Increments

Name	Position Encoder Increments
Index	0x608F
Sub Index	0x01
Data Type	UNSIGNED32
Access Type	RW
Unit	Count
Default Value	500
Value Range	400 40000
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.130.2 Position Encoder Motor Revolution

Name	Position Encoder Motor Revolution
Index	0x608F
Sub Index	0x02
Data Type	UNSIGNED32
Access Type	RW
Unit	Count
Default Value	1
Value Range	1 1
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

6.2.131 0x6098 : Homing Method

This object is used to select the desired Homing Method.

If the Homing Method is changed during an ongoing homing process, the new homing method will not be applied until the next homing process starts.

Name	Homing Method
Index	0x6098
Sub Index	0x00
Data Type	INTEGER8
Access Type	RW
Unit	Number
Default Value	17
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
37	Actual Position
27	Home Switch Negative Speed
23	Home Switch Positive Speed
18	Positive Limit Switch
17	Negative Limit Switch
-3	Current Threshold Positive Speed
-4	Current Threshold Negative Speed

6.2.132 0x6099 : Homing Speeds

This object indicates the speed value used for the homing sequence.

Name	Homing Speeds
Index	0x6099
Data Type	RECORD
Number of Entries	2

6.2.132.1 Speed for Switch Search

This object indicates the speed value used for the limit switch search in the homing sequence.

Name	Speed for Switch Search	
Index	0x6099	
Sub Index	0x01	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	100	
Value Range	1	25000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.132.2 Speed for Zero Search

This object indicates the speed value used for the zero position search in the homing sequence.

Name	Speed for Zero Search	
Index	0x6099	
Sub Index	0x02	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	10	
Value Range	1	25000
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.133 0x609A : Homing Acceleration

This object is used to define the acceleration and deceleration in the homing profile.

Name	Homing Acceleration	
Index	0x609A	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	10000	
Value Range	1	4294967295
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.134 0x60A4 : Profile Jerk

This object indicates the Jerk value used to generate the profile motion trajectory.

Name	Profile Jerk
Index	0x60A4
Data Type	RECORD
Number of Entries	1

6.2.134.1 S-Curve profile Jerk

This object indicates the Jerk value used to generate the Sinusoidal trajectory.

Name	S-Curve Profile Jerk	
Index	0x60A4	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s ²	Linear: mm/s ³
Default Value	10000	
Value Range	1	2147483647
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.135 0x60B0 : Position Offset

This object provides the Position Offset.

In the CSP, this object provides the offset for the Target Position. It contains additional commanded positions of the drive, which are inserted in the Target Position.

Name	Position Offset	
Index	0x60B0	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	Count	
Default Value	0	
Value Range	-2147483648	2147483647
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.136 0x60B1 : Velocity Offset

In the CSV, this object provides the offset for the Target Velocity. The value itself is an absolute value but represents an additional velocity value. Therefore, for the Target Velocity, it can be used for drive control by using a relative value.

Name	Velocity Offset	
Index	0x60B1	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	0	
Value Range	-Maximum Motor Speed	+Maximum Motor Speed
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.137 0x60B2 : Torque Offset

This object provides the Torque Offset, which is displayed in 1/1000 of the "Motor Rated Torque."

In the CSP, this object contains the input value for the torque feed-forward.

In the CST, this object contains additional commanded torque of the drive, which is inserted in the Target Torque.

Name	Torque Offset	
Index	0x60B2	
Sub Index	0x00	
Data Type	INTEGER16	
Access Type	RW	
Unit	0.1%	
Default Value	0	
Value Range	-1000	+1000
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.138 0x60C5 : Maximum Acceleration

This object is used to set the max permissible acceleration limits to prevent mechanical damage.

It indicates the limits of motor acceleration objects. This object is not factored in the CSP, CSV, and CST.

Name	Maximum Acceleration	
Index	0x60C5	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	4294967295	
Value Range	1	4294967295
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.139 0x60C6 : Maximum Deceleration

This object is used to set the max permissible deceleration limit to prevent mechanical damage.

It indicates the limits of motor deceleration objects. This object is not factored in the CSP, CSV, and CST.

Name	Maximum Deceleration	
Index	0x60C6	
Sub Index	0x00	
Data Type	UNSIGNED32	
Access Type	RW	
Unit	Revolute: RPM/s	Linear: mm/s ²
Default Value	4294967295	
Value Range	1	4294967295
PDO Mapping	NO	
Backup	YES	
Fieldbus Type	CANopen, EtherCAT	

6.2.140 0x60E3 : Supported Homing Methods

This object indicates the supported homing methods.

Name	Supported Homing Methods
Index	0x60E3
Data Type	RECORD
Number of Entries	7

6.2.140.1 Homing Method 0~ 6

Name	Homing Methods 0 ~ 6
Index	0x60E3
Sub Index	0x00 ~ 0x06
Data Type	INTEGER16
Access Type	RO
Unit	Number
Default Value	See table below
Value Range	- -
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Subindex	Name	Default Value	Description
0x01	Homing Method 0	17	Negative Limit Switch
0x02	Homing Method 1	18	Positive Limit Switch
0x03	Homing Method 2	23	Home Switch Positive Speed
0x04	Homing Method 3	27	Home Switch Negative Speed
0x05	Homing Method 4	37	Actual Position
0x06	Homing Method 5	-3	Current Threshold Positive Speed
0x07	Homing Method 6	-4	Current Threshold Negative Speed

6.2.141 0x60F4 : Following Error Actual Value

This object indicates the actual value of the Following Error.

Name	Following Error Actual Value
Index	0x60F4
Sub Index	0x00
Data Type	INTEGER32
Access Type	RO
Unit	Count
Default Value	0
Value Range	-2147483648 2147483647
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.142 0x60FD : Digital Inputs

This object displays the status of the Digital Input function.

Name	Digital Inputs
Index	0x60FD
Sub Index	0x00
Data Type	UNSIGNED32
Access Type	RO
Unit	Bit
Default Value	0
Value Range	See table below
PDO Mapping	TxPDO MAPPING
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Bit	Description
0	Negative Limit
1	Positive Limit
2	Home
3	Brake In(Emergency)
4	Digital Input0
5	Digital Input1
6	Digital Input2
7	Digital Input3
8..31	Reserved

6.2.143 0x60FE : Digital Outputs

Name	Digital Outputs
Index	0x60FE
Data Type	RECORD
Number of Entries	2

6.2.143.1 Physical Outputs

Name	Physical Outputs
Index	0x60FE
Sub Index	0x01
Data Type	UNSIGNED32
Access Type	RW
Unit	Bit
Default Value	0
Value Range	See table below
PDO Mapping	RxPDO MAPPING
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Bit	Description
0	Brake Output
1	Digital Output0
2	Digital Output1
3	Digital Output2
4	Digital Output4
5	Digital Output5
6..31	Reserved

6.2.143.2 Output Mask

Name	Output Mask
Index	0x60FE
Sub Index	0x02
Data Type	UNSIGNED32
Access Type	RW
Unit	Bit
Default Value	0
Value Range	
PDO Mapping	RxPDO MAPPING
Backup	NO
Fieldbus Type	CANopen, EtherCAT

6.2.144 0x60FF : Target Velocity

This object indicates the Target Velocity in the speed mode (PVM, VRM, and CSV).

Name	Target Velocity	
Index	0x60FE	
Sub Index	0x00	
Data Type	INTEGER32	
Access Type	RW	
Unit	Revolute: RPM	Linear: mm/s
Default Value	0	
Value Range	PVM: -Maximum Profile Velocity VRM, CSV: -Maximum Velocity"	PVM: +Maximum Profile Velocity VRM, CSV: +Maximum Profile Velocity
PDO Mapping	RxPDO MAPPING	
Backup	NO	
Fieldbus Type	CANopen, EtherCAT	

6.2.145 0x6402 : Motor Type

Name	Motor Type
Index	0x6402
Sub Index	0x00
Data Type	UNSIGNED16
Access Type	RW
Unit	-
Default Value	0x0001
Value Range	See table below
PDO Mapping	NO
Backup	YES
Fieldbus Type	CANopen, EtherCAT

Value	Description
0x0001	Brushed DC Motor
0x000A	Sinusoidal PM BL Motor
0x000B	Trapezoidal PM BL Motor
0x8001	Linear Brushed DC Motor
0x800A	Linear Sinusoidal PM BL Motor
0x800B	Linear Trapezoidal PM BL Motor
0x800C	Linear Voice Coil Motor

6.2.146 0x6502 : Supported Drive Modes

This object indicates the supported drive modes.

Name	Supported Drive Modes
Index	0x6502
Sub Index	0x00
Data Type	UNSIGNED32
Access Type	CONST
Unit	-
Default Value	0x03AF
Value Range	See table below
PDO Mapping	NO
Backup	NO
Fieldbus Type	CANopen, EtherCAT

Bit	Description
0	profile position mode
1	velocity mode
2	profile velocity mode
3	profile torque mode
4	reserved
5	homing mode
6	interpolated position mode
7	cyclic synchronous position mode
8	cyclic synchronous velocity mode
9	cyclic synchronous torque mode
10...15	reserved
16...31	manufacturer-specific

- If the bit is 1, this indicates that the corresponding mode is supported.



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