



EtherCAT Reference Manual

BDHDE Servo Drive

EB Models

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1. Introduction

1.1 About This Manual

Drive functionality is configured using various commands and variables, which are communicated over the serial port or over a fieldbus.

This manual describes the implementation of CANopen over EtherCAT (CoE) communication in the BDHDE servo drives.

This manual is intended for skilled personnel who have been trained to work with the equipment described.

1.2 Manual Format

The CAN objects are presented and described in the following format:

nnnnh – Object Name

Object Description

Index	<i>nnnn</i>
Description	Description of the object
Object Code	Variable | Array | Record
Data Type	Integer8 | Integer16 | Integer32 Unsigned8 | Unsigned16 | Unsigned32 Real32 | Visible_String
Category	Optional | Mandatory
VarCom	VarCom equivalent

Entry Description for Variable and Record Objects

Access	Read/Write Read and write access Read Only Read only Constant Read only access, value is constant
PDO Mapping	Yes | No
Value Range	Discrete values and ranges of values.
Default Value	The object's default value.
Units	When the object value implies units of measure, these units are specified.

Entry Description for Array Objects

Sub-Index	<i>nnn</i>
Description	Description of the sub-index
Object Code	Variable | Array | Record
Data Type	Integer8 | Integer16 | Integer32 Unsigned8 | Unsigned16 Unsigned32 | Real32 | Visible_String
Category	Optional | Mandatory
Access	Read/Write Read and write access Read Only Read only Constant Read only access, value is constant
PDO Mapping	Yes | No
Value Range	Discrete values and ranges of values.
Default Value	The object's default value.
Units	When the object value implies units of measure, these units are specified.

2 Fieldbus Wiring and Setup

2.1 Fieldbus Wiring (Examples)

2.1.1 BDHDE – EtherCAT Configuration – softMC 7 Controller – Example

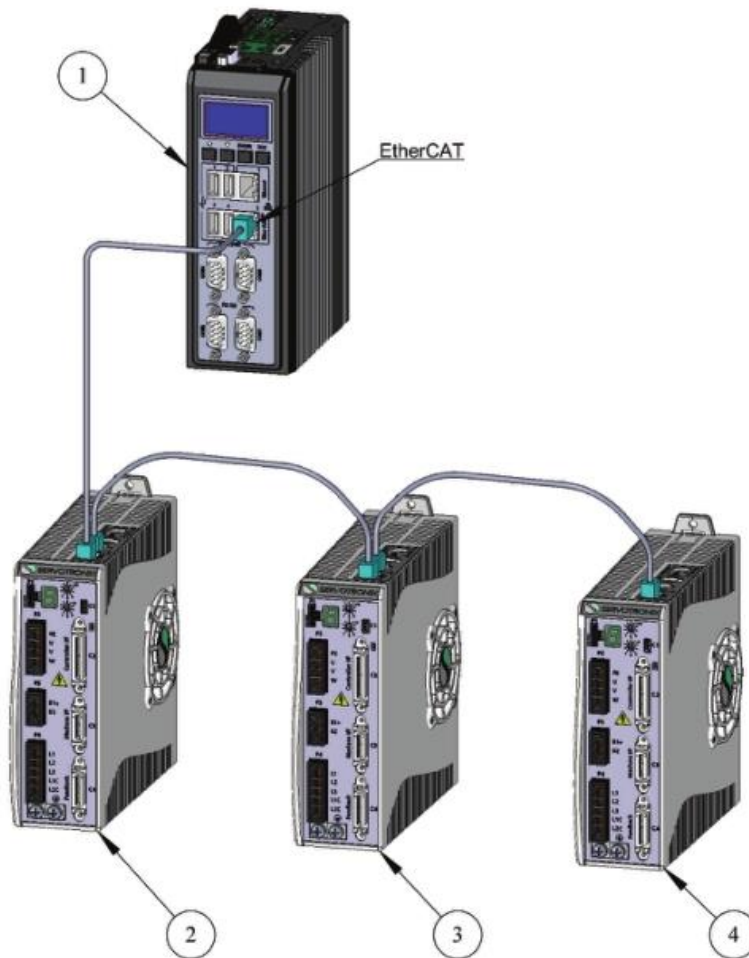


Figure 2-4. BDHDE – EtherCAT Configuration – softMC 7 Controller –Example

1	softMC 7 Controller
2, 3, 4	BDHDE

2.1.2 BDHDE – EtherCAT Configuration – Beckhoff Controller – Example

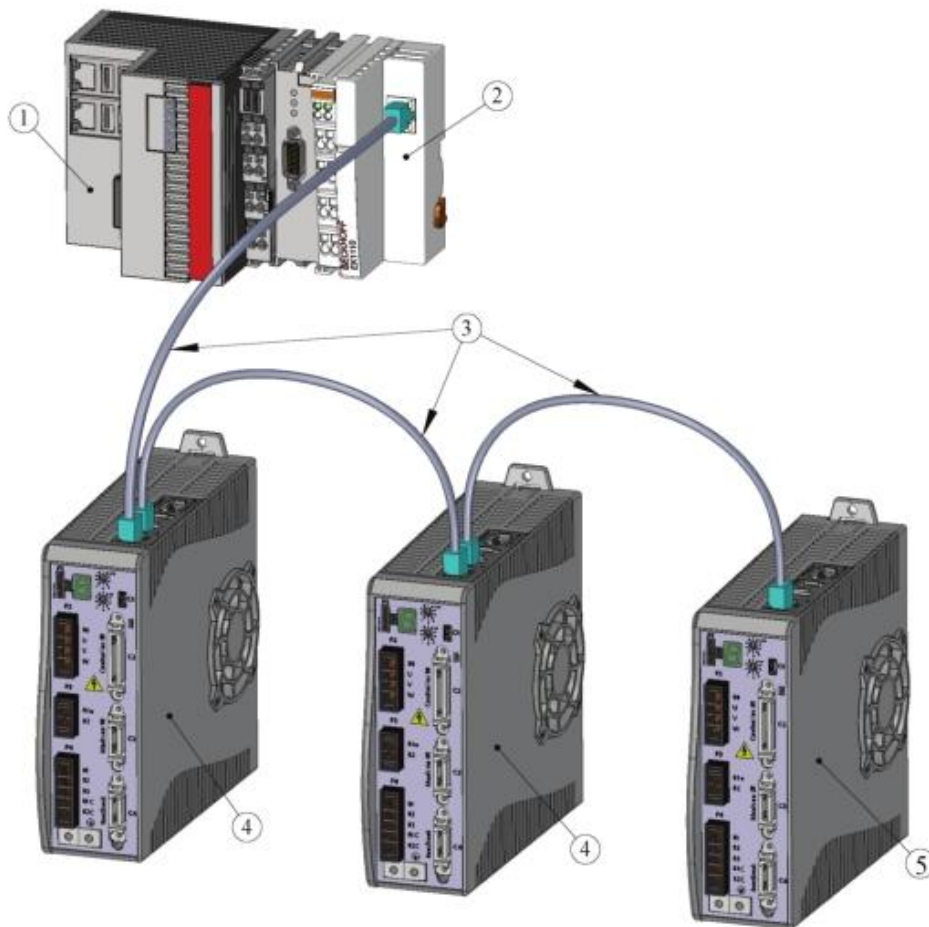


Figure 2-5. BDHDE – EtherCAT Configuration – Beckhoff Controller Example

1	PLC or embedded PC
2	EtherCAT module
3	RJ45 cables
4 / 5	BDHDE

2.2 Node Address

2.2.1 Node Address in EtherCAT Network

Within an EtherCAT network, a physical node address (identification number) does not have to be specifically allocated to a device; the EtherCAT controller will assign the address.

Two or more drives connected in the EtherCAT network can be set at the same physical address; the EtherCAT controller will automatically set the slave IDs.

2.3 Command Interface Mode

Certain parameters, such as the command interface mode, are factory-defined in the drive's firmware, and can only be modified by means of the ServoStudio software. Note that

ServoStudio requires a serial (USB or RS232) connection between the host computer and the drive.

The drive is factory-configured for the fieldbus (Ethernet) command interface, which is defined by the drive parameter `COMMmode=1`.

If necessary, you can enable the EtherCAT command interface mode through the ServoStudio **Terminal** screen. Enter the command **COMMmode 1** and then issue the serial command **SAVE**.

Alternately, you can easily select the **Interface Mode** in the ServoStudio **Drive Information** screen.

EtherCAT	SERVO ON (ACTIVE) and motion commands are transmitted via an EtherCAT interface.	COMMmode 1
Serial	SERVO ON (ACTIVE) and motion commands are transmitted via a serial interface.	COMMmode 0

2.3.1 Communication in EtherCAT Network

When using EtherCAT communication, be sure the required XML file is installed in the PLC controller or host computer. You can download the file from the Servotronix website or contact Technical Support.

Using any RJ45 cables:

- Connect the host to the drive on interface C5.
- Connect the next node to interface C6.



Figure 2-9. BDHDE EtherCAT ports

Connectors C5 and C6 function as transmitter (Tx) and receiver (Rx), respectively.

Interfaces C5 and C6 (on EB and EB models) each have two LEDs that indicate the fieldbus status when communicating on an EtherCAT network:

- **Green:**
 - **Flashing** – Communication activity
 - **Not lit** – No communication activity
- **Orange:**
 - **Steadily lit** – Operational (OP) state
 - **Slow flashing** – Safe-Operation (SAFEOP) state
 - **Fast flashing** – Pre-Operational (PREOP) state
 - **Very fast flashing** – Bootstrap (BOOT) state

- **Not lit** – Initial (INIT) state

2.4 Interpolation Time (Cyclic Synchronous)

The drive parameters FBITPRD and FBITIDX define, respectively, the interpolation time period and time index used for calculating fieldbus cyclic sync time in Cyclic Synchronous modes of operation.

The following equation defines the relationship of these parameters:

$$\text{FBITPRD} \times 250 = \text{Fieldbus cyclic synchronous time, in microseconds.}$$

The setting range of FBITPRD is from 1 to 64, the time index of FBITIDX is fixed -4 stands for 250us in BDHDE.

It is possible to set these parameters through object 60C2h sub-indices 1 and 2.

During INIT state, the host controller must set the values of the indexes to the equivalent cycle time as the controller.

If necessary, you can manually set the value of FBITPRD and FBITIDX through the ServoStudio **Terminal** screen. After setting FBITPRD and FBITIDX, you must issue the serial command **SAVE**.

3 Configuring softMC Controller for Use with BDHDE EtherCAT (EB) Drive

Information on configuring the softMC controller for use with BDHDE can be found in the softMC documentation wiki:

The articles should be accessed and read in the following order:

1. http://softmc.servotronix.com/wiki/Category:EtherCAT:EB_SETUP
2. http://softmc.servotronix.com/wiki/EtherCAT:EB_INSTALL_STX_BDHDE

To login to the softMC wiki:

- Username: softMC
- Password: documentation

For additional assistance with the installation and configuration, contact Servotronix Technical Support.

4 Configuring Beckhoff Controller for Use with BDHDE EtherCAT (EB) Drive

This chapter explains how to configure the Beckhoff controller for communication and operation with the BDHDE EB models.

The application system consists of the following elements:

- BDHDE EB Ethernet servo drive, servo motor, and ServoStudio software.
- Beckhoff controller with EtherCAT communication module, and TwinCAT software.

Notes

- Beckhoff controller refers to TwinCAT NC PTP (point-to-point axis positioning software).
- TwinCAT NC PTP includes axis positioning software (set value generation, position control), an integrated software PLC with NC interface, operating program for commissioning and an I/O connection to the axes through various fieldbuses. TwinCAT NC PTP replaces conventional positioning modules and NC controllers. The controllers that are simulated by the PC cyclically exchange data with drives and measuring systems via the fieldbus.
- Beckhoff controllers are programmed in accordance with the IEC 61131-3 programming standard.

4.1 BDHDE Hardware and Software Settings

Refer to the chapter *Fieldbus Wiring and Setup*. The diagram in Figure 2-5 shows a setup with a Beckhoff controller.

Make sure all hardware settings are in accordance with the instructions in the following sections.

- Fieldbus Wiring
- Node Address
- Termination Resistor Switch
- Command Interface Mode
- CAN Bus Bit Rate
- Interpolation Time

Before activating the **TwinCAT System Manager**, make sure the correct ***.xml** file (according to the firmware version) resides at C:\TwinCAT\lo\EtherCAT.

4.2 Communication between Controller and PC

Using **TwinCAT** software, establish communication between the controller and the PC by performing the following steps.

1. Activate **TwinCAT** software.
2. In the navigation pane, select **SYSTEM – Configuration**. Then, in the **Version (Local)** tab, click **Choose Target**.

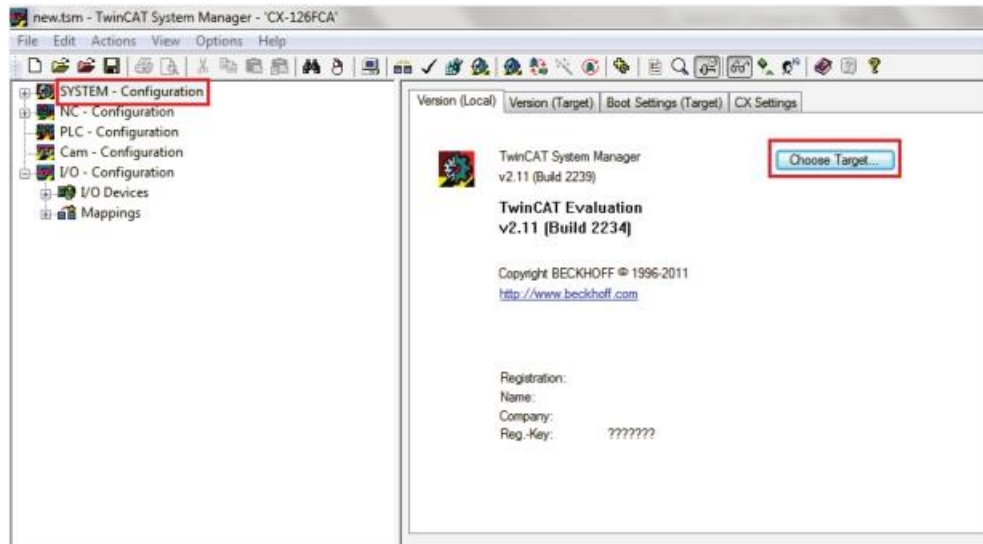


Figure 4-1.

3. Click **Search (Ethernet)** to search for the controller in the network.

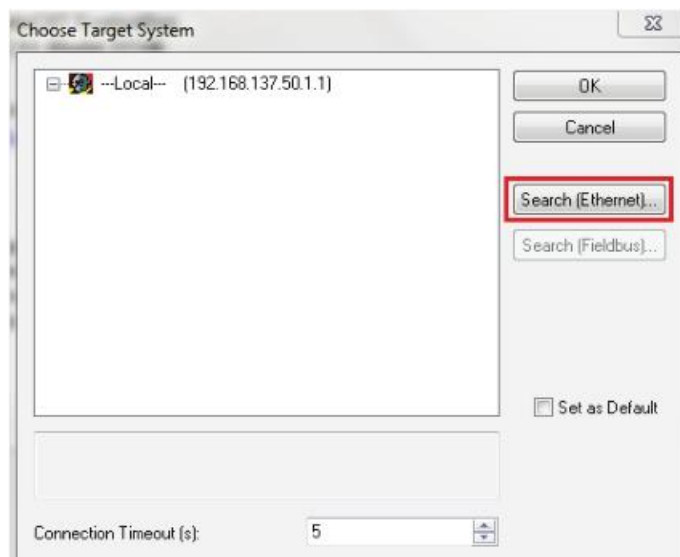


Figure 4-2.

4. Enable the option **IP Address**, and click **Broadcast Search**.
Wait for the controller name (in the format CX-xxx) to appear.

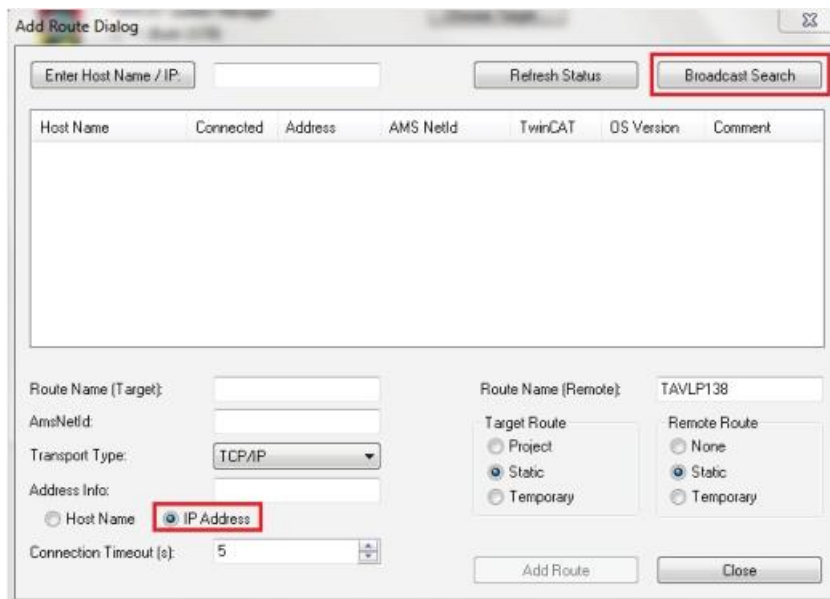


Figure 4-3.

5. After the controller appears, the option **Add Route** is displayed.
Click Add Route
6. In the Logon dialog box, enter the following:
User Name: **Administrator**
Password: 1
Click **OK**.



Figure 4-4.

7. In the Add Route dialog box, be sure an X appears next to the controller name. This means the controller is properly connected to the PC.
Close this dialog box.

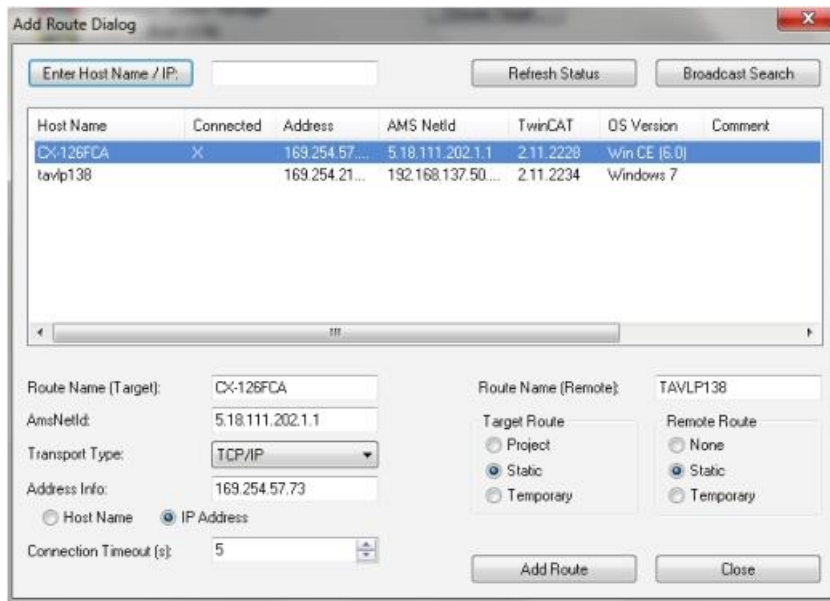
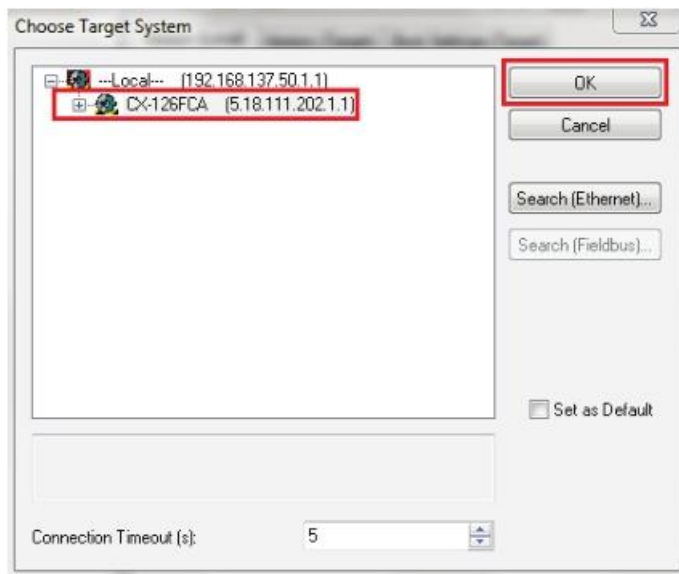


Figure 4-5.

- In the Choose Target System dialog box, click on the controller, and click **OK**.



- Open the TwinCAT System Manager, and make sure it is in Config Mode.



Figure 4-6.

4.3 Communication between Controller and Drive

Using **TwinCAT** software, establish communication between the controller and the drive by performing the following steps.

- In the navigation pane, expand **I/O-Configuration**, and then right-click on **I/O Devices**.

2. Select **Scan Devices**.

At the prompt, click **OK**.

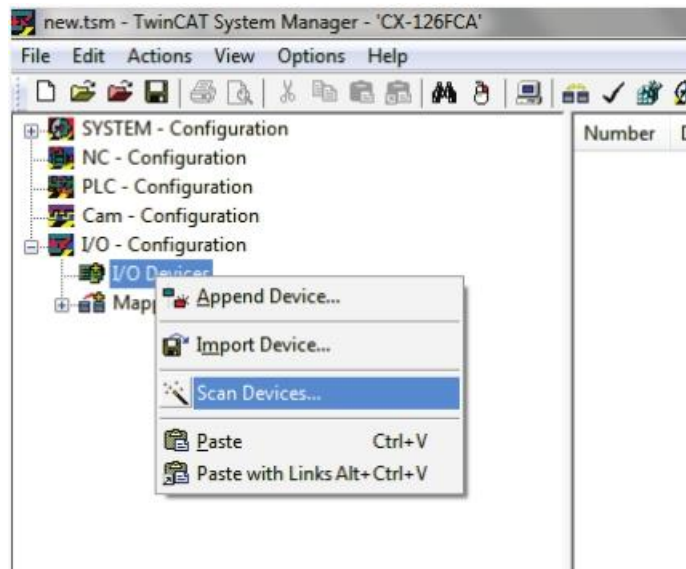


Figure 4-7.

3. After the scanning, detected devices are displayed.
BDHDE is identified as **Device 1 (EtherCAT)**.

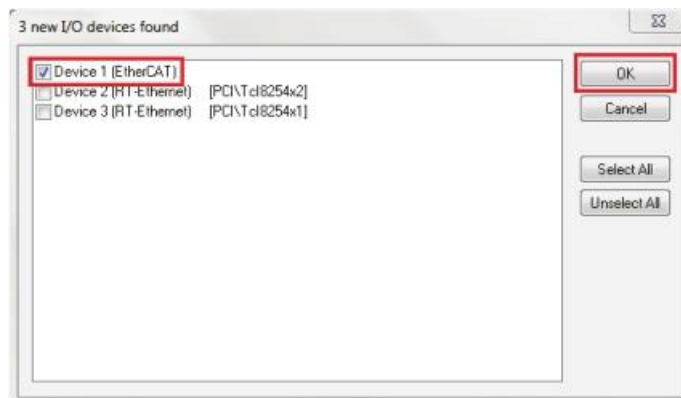


Figure 4-8.

4. Enable the option **Device 1 (EtherCAT)**, and click **OK**.
5. At the prompt to scan for boxes (slaves), click **Yes**.



Figure 4-9.

6. At the prompt to append the linked axis to the NC configuration, click **Yes**.

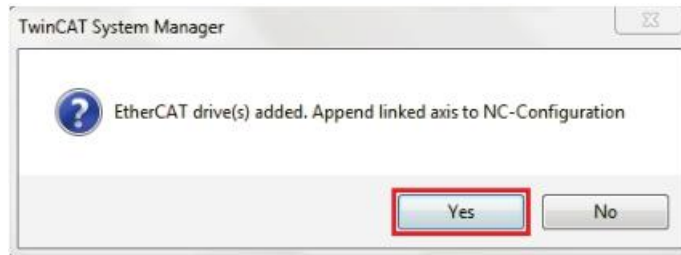


Figure 4-10.

7. At the prompt to activate FreeRun, click **No**.



Figure 4-11.

8. At the end of this procedure, **Device 1 (EtherCAT)** is displayed in the navigation pane, with all components (TPDO and RPDO) listed and automatically linked to **NC-Configuration>Axis 1**.

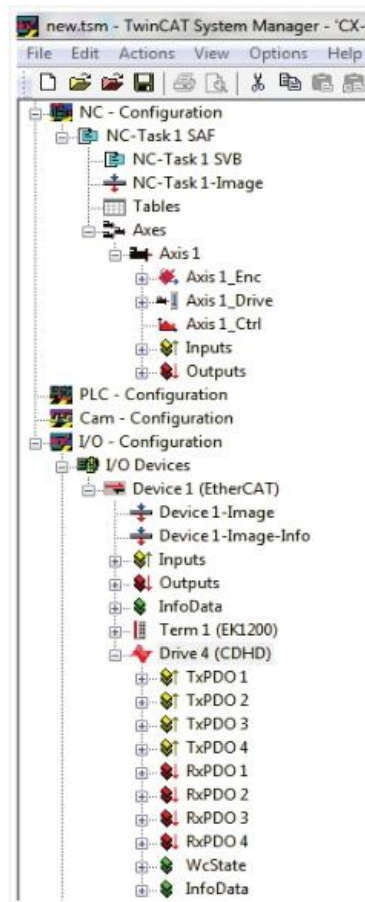


Figure 4-12.

4.4 Generating Motion

4.4.1 Setup for Motion

1. Open the TwinCAT System Manager, and make sure it is in **Config Mode**.



Figure 4-13.

2. In the navigation pane, expand **SYSTEM-Configuration**, and select **Real Time Settings**.
 - In the **Settings** tab, select Base Time = 1 ms.

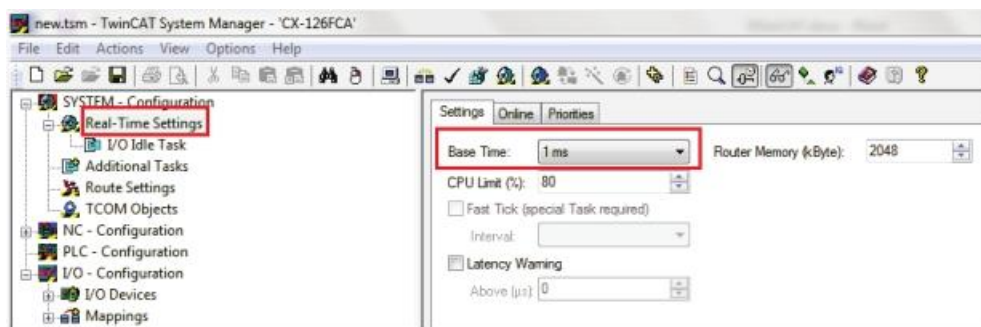


Figure 4-14.

- In the **Priorities** tab, enable **Automatic Priority Management**.

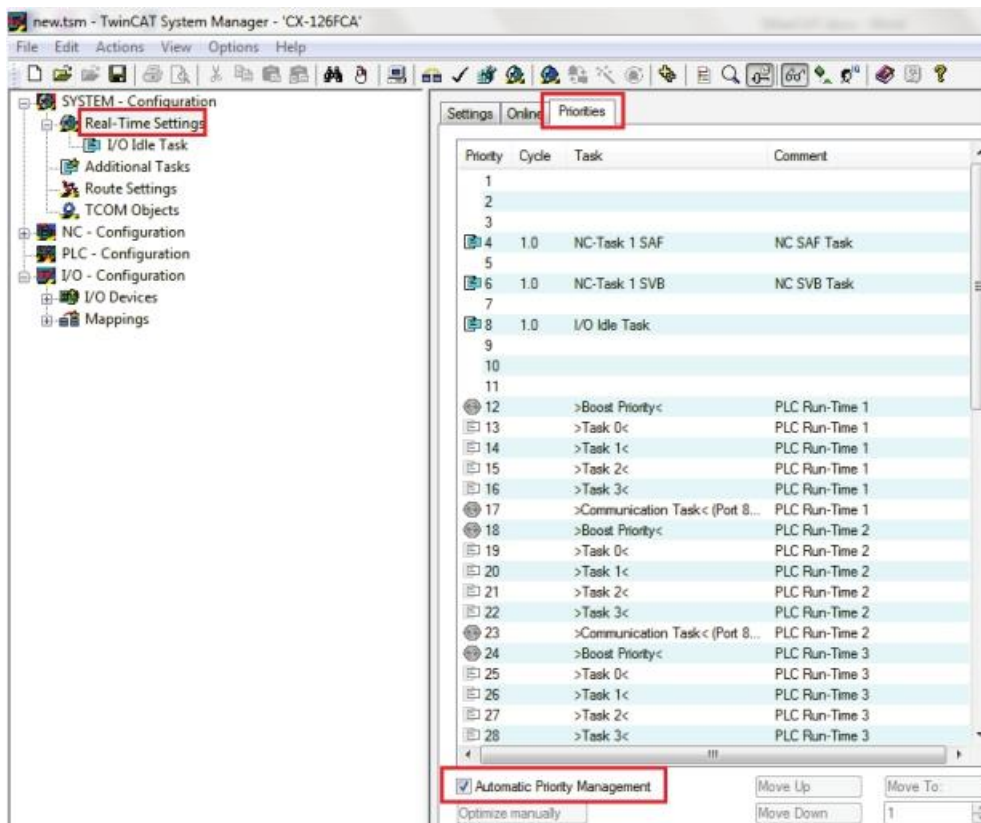


Figure 4-15.

3. Expand **SYSTEM-Configuration**, and select Real Time Settings > **I/O Idle Task**.
In the **Task** tab, select Cycle ticks = 1 ms.

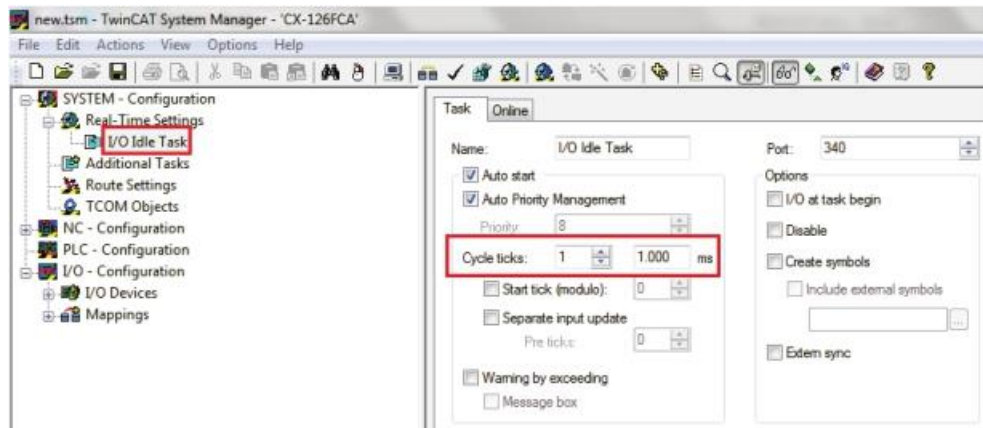


Figure 4-16.

4. In the navigation pane, expand **NC-Configuration**, and select **NC-Task1SAF**.
 - In the **Task** tab, select Cycle ticks = 1 ms.

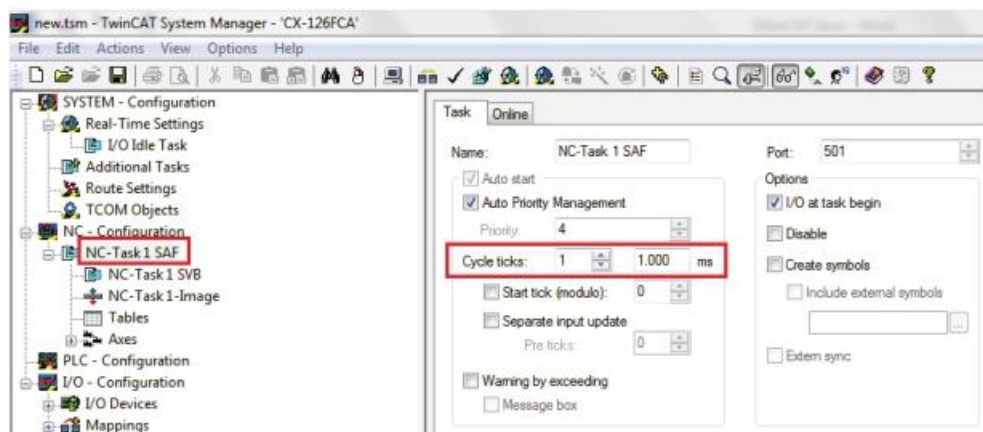


Figure 4-17.

5. Expand **NCT-Task1SAF**, and select **NC-Task1SVB**.
 - In the **Task** tab, select Cycle ticks = 1 ms.
 - Be sure the priority of NC-Task1 SVB has a higher value than the priority of NC-Task1 SAF.

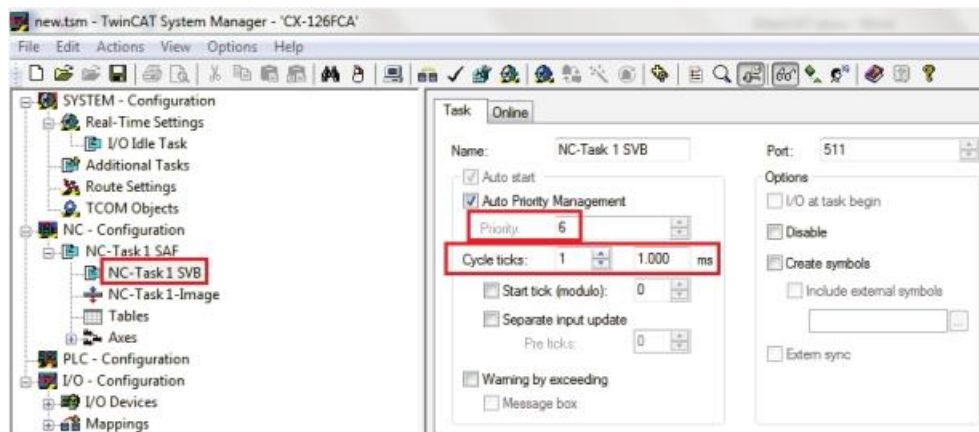


Figure 4-18.

6. Expand **NC-Configuration** > **Axes** > **Axis 1** > **Axis 1_Enc.**

In the **Parameter** tab, do the following:

- **Encoder Evaluation** > **Scaling Factor** = 1.

Click **Download**.

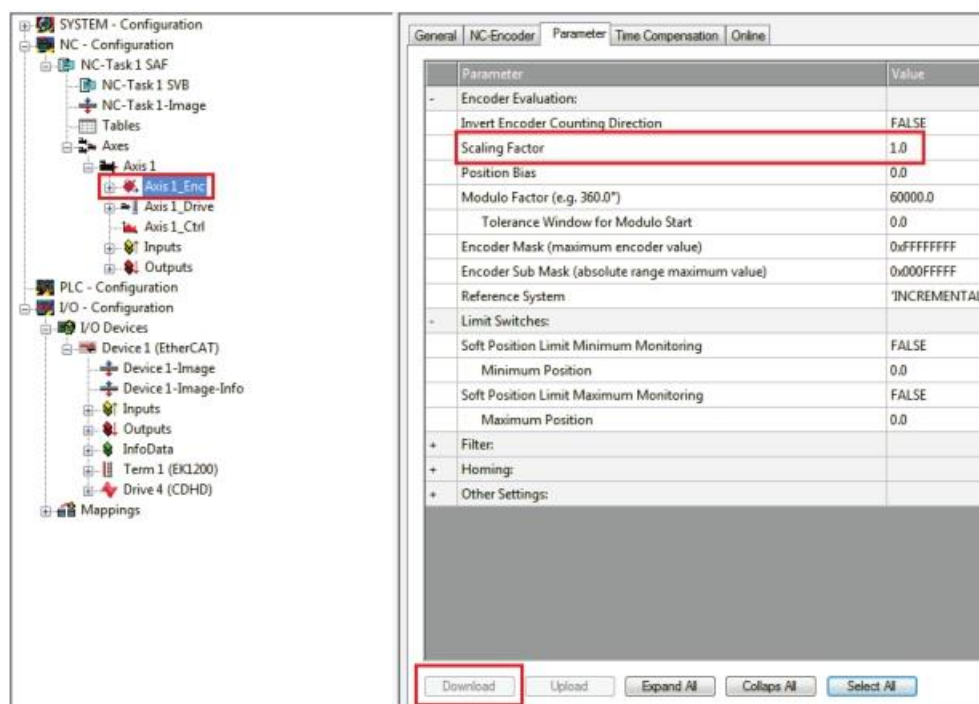


Figure 4-19.

- **Encoder Evaluation** > **Modulo Factor** = PNUM value.

Click **Download**.

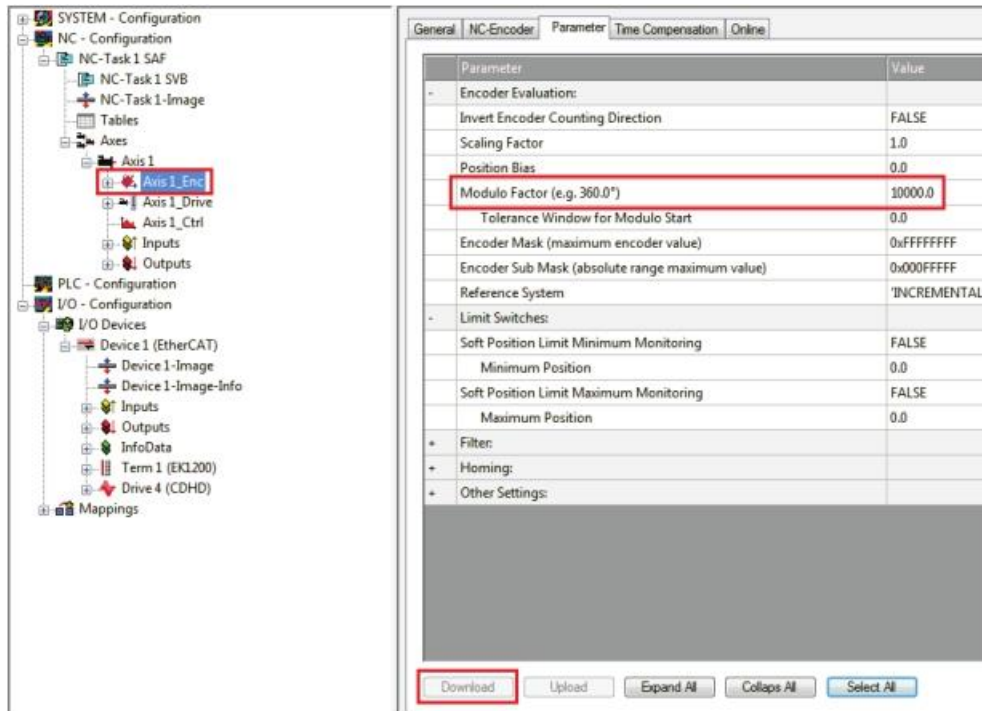


Figure 4-20.

7. Expand **NC-Configuration** > Axes > Axis 1 > **Axis 1_Ctrl**.

In the **Parameter** tab, do the following:

- **Monitoring** > Position Lag Monitoring = FALSE

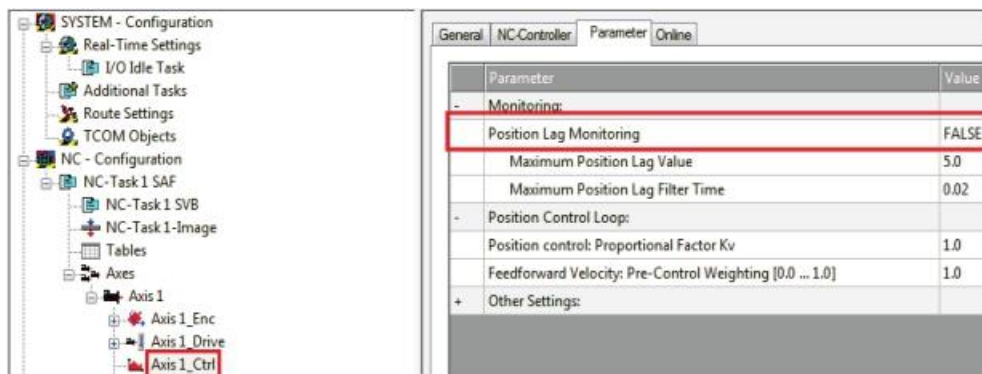


Figure 4-21.

8. Expand **IO-Configuration** > **I/O Devices** > Device (EtherCAT), and select the drive indicated by the red icon.

- In the **DC** tab, select Operation Mode = **DC-Synchronous**

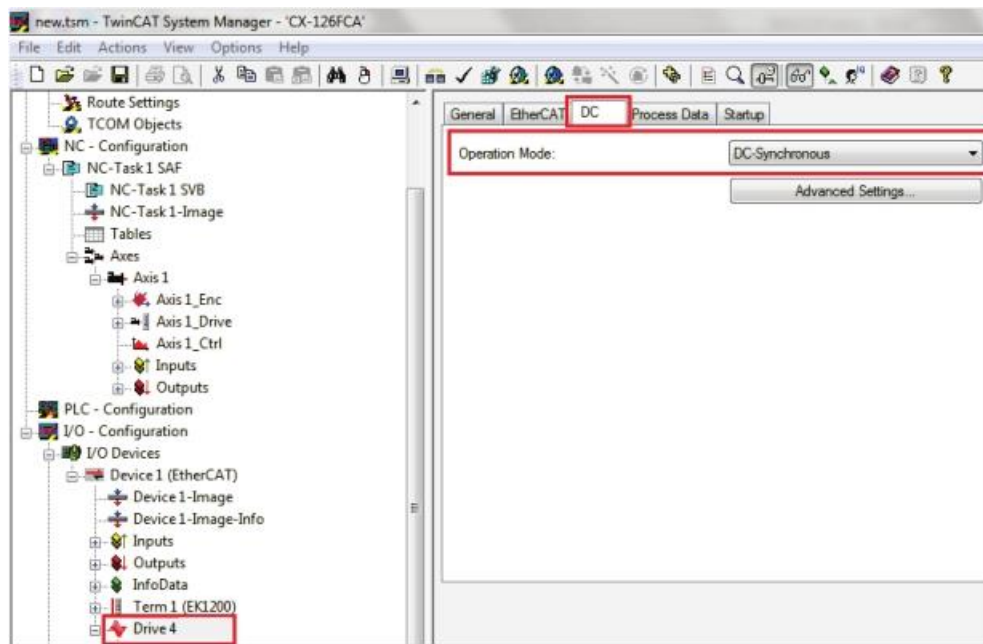


Figure 4-22.

9. Press the **Run Mode** button in the toolbar.



Figure 4-23.

Additional tabs are now available.

10. Go to the **CoE Online** tab.

The CoE Online tab shows only the SDO objects (BDHDE EtherCAT parameters) that the drive manages.

Be sure the values of the objects 6060h and 60C2h are as follows:

- Object **6060h** = **8**

The drive is set to Cyclic Synchronous Position mode, OPMODE 8, through protocol object 6060h.

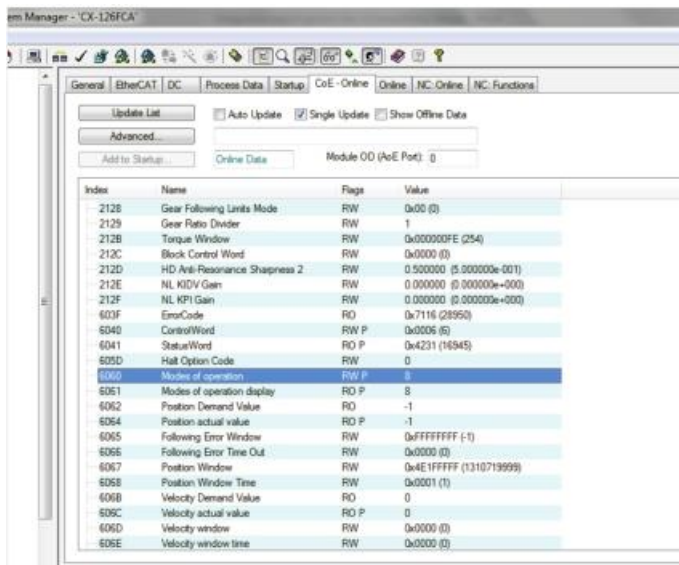


Figure 4-24.

- Object 60C2h:

Sub-index 01 (**60C2:01**) = 1

Sub-index 02 (**60C2:02**) = -3

The interpolation time for the Cyclic Synchronous operation modes is set through object 60C2h (sub-index 01 and sub-index 02).

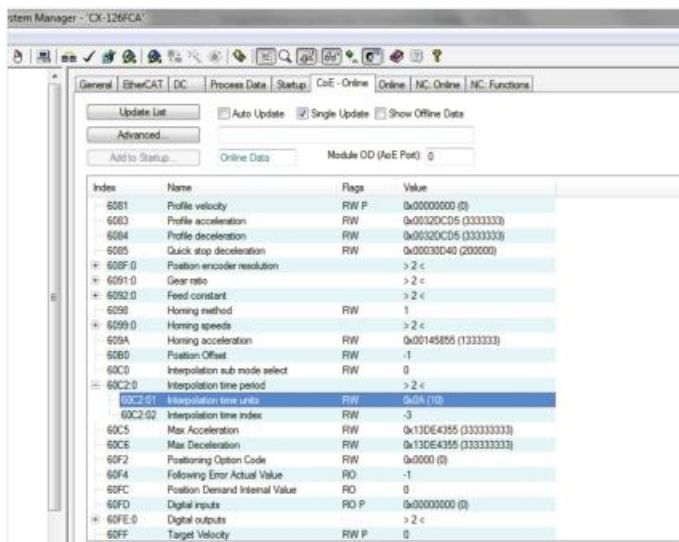


Figure 4-25.

Note

The interpolation time must be configured with the same value of cycle ticks as configured in I/O Idle Task, in NC-Task 1 SAF, and in NC-Task 1 SVB.

11. Now activate **Run Mode** by pressing the following two buttons in the toolbar:

- Generate Mappings
- Check Configuration

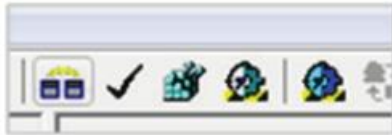


Figure 4-26.

In Run mode, motion can be generated. The NC PTP communicates with the drive and receives all the values of the variables contained in each of the PDO objects (which were automatically mapped by the controller).

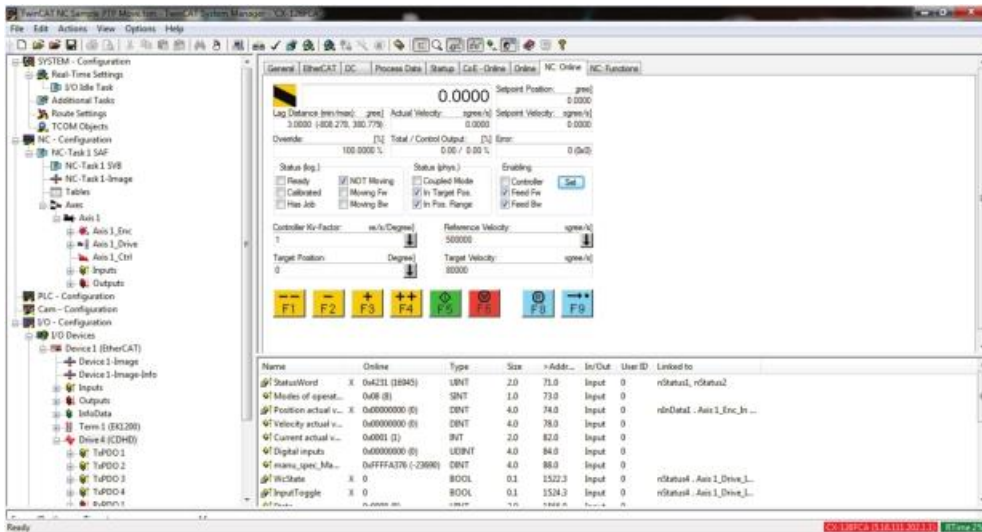


Figure 4-27.

12. In the **NC-Online** tab, test communication with the drive:

Take hold of the motor shaft, and turn it manually; check whether the position feedback value changes.

Refer to the following figure, which shows the various functions.

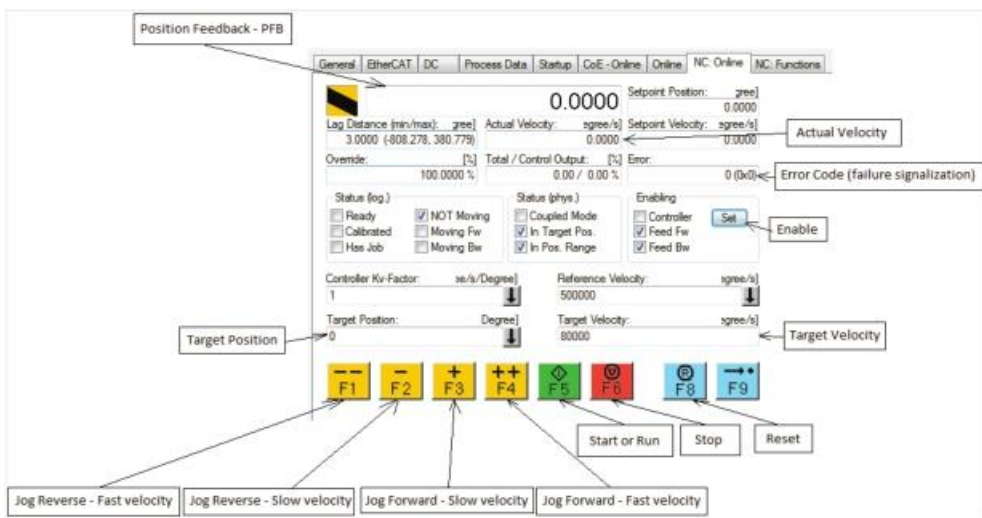


Figure 4-28.

4.4.2 Generating Motion in Cyclic Synchronous Position Mode

The following steps demonstrate how to generate a motion in Cyclic Synchronous Position mode. In the **NC-Online** tab, you will send a target position with a velocity to the drive. The controller will execute a motion profile.

1. Enable the drive:
 - a. NC-Online Screen > **Enabling** > **Set**
 - b. Enable the options: **Controller**, **Feed Fw** and **Feed Bw**, or select **All**
 - c. **OK**

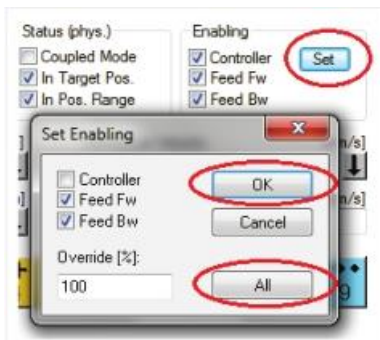


Figure 4-29.

Note To disable the drive:
 NC-Online Screen > **Enabling** > Clear the option **Controller** > **OK**

2. Use the motion buttons – F1, F2, F3 and F4 to generate the following motion profiles.
 Configure the velocity in the controller using **NC-Configuration** > **NC- Task1 SAF** > **Axes** > **Axis1** > **Parameters** > **Manual Velocity** (Slow and Fast), as shown in the following figure.

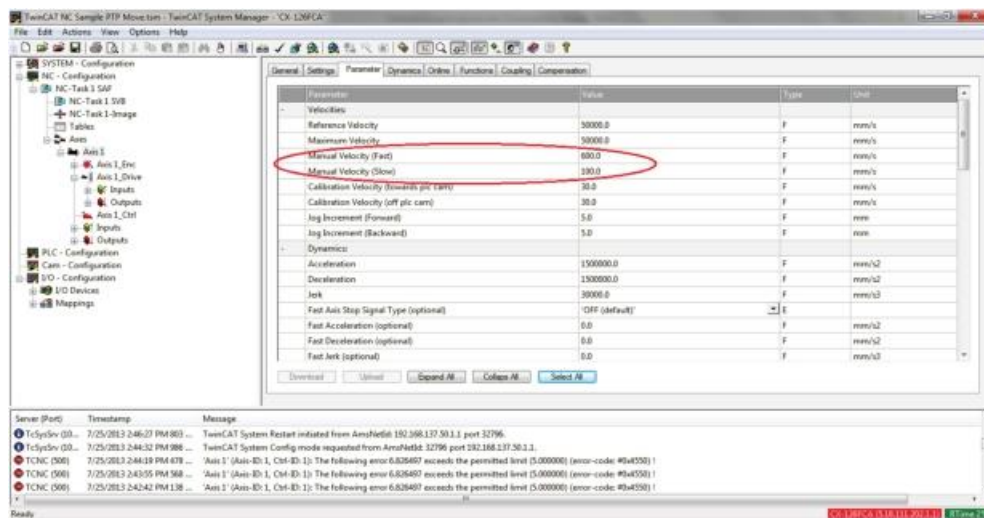


Figure 4-30.

- **F1**: Sends a jog command in the negative direction (CCW) with a fast velocity.

- **F2**: Sends a jog command in the negative direction (CCW) with slow velocity.
 - **F3**: Sends a jog command in the positive direction (CW) with slow velocity.
 - **F4**: Sends a jog command in the positive direction (CW) with fast velocity.
3. Set values for **Target Position** and **Target Velocity** as shown in the following figure.

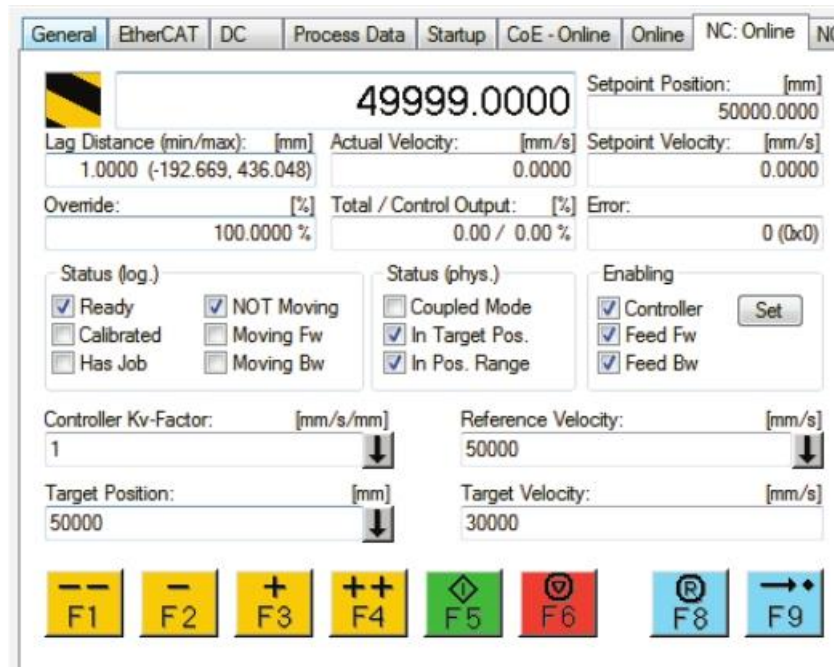


Figure 4-31.

4. Press **F5** (green button) to start the motion profile in Synchronous Position mode.
- Press **F6** (red button) to stop the motion.
 - Press **F8** (blue button) to clear any faults.

The graph in the following figure reflects the motion performed:

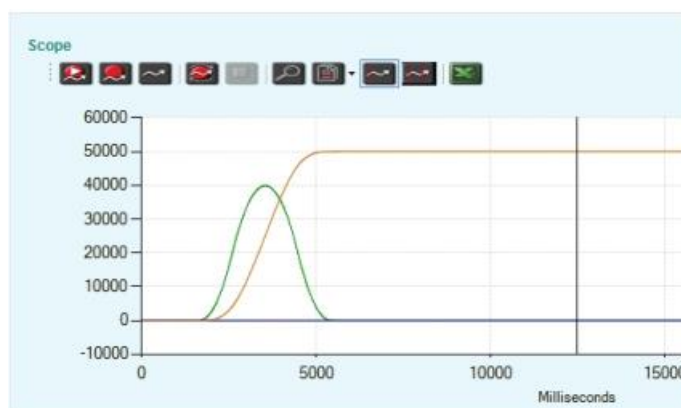


Figure 4-32.

- Brown line = Position feedback – PFB
- Green line = Point to point generator velocity command – PTPVCMD
- Blue line = Position error – PE

- X axis = milliseconds, Y axis = counts

4.4.3 Generating Absolute and Relative Motion

To generate absolute or relative motion in Position Profile mode, refer to the following two figures, and do the following:

1. Go to the Functions tab.
2. Configure the target position, the target velocity, the acceleration and deceleration, and the jerk of the motion.

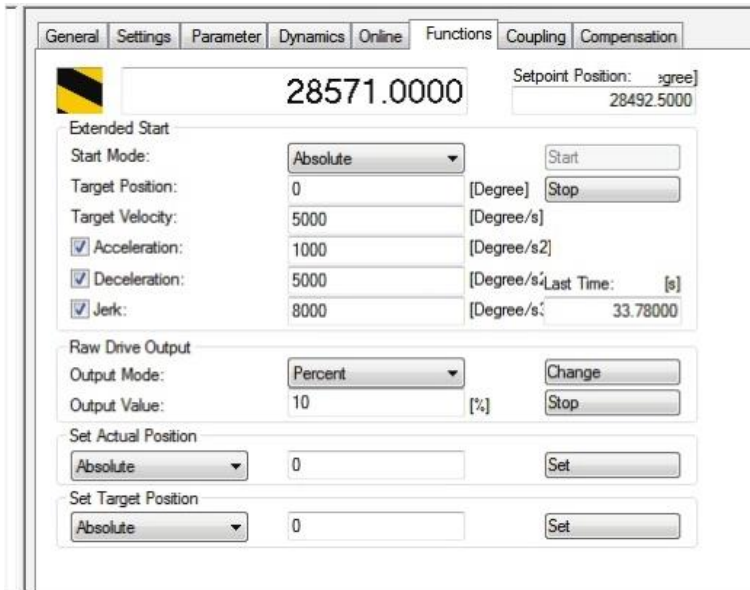


Figure 4-33.

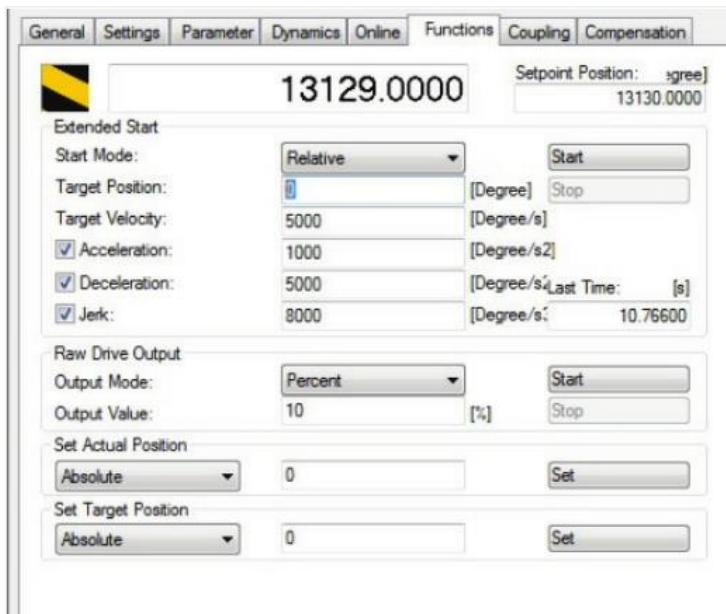


Figure 4-34.

4.4.4 Generating a Step Motion

To generate a step sequence in the Velocity profile, refer to the following two figures, and do the following:

1. Go to the Functions tab.
2. Configure the target velocity, and a time (duration) for the step.

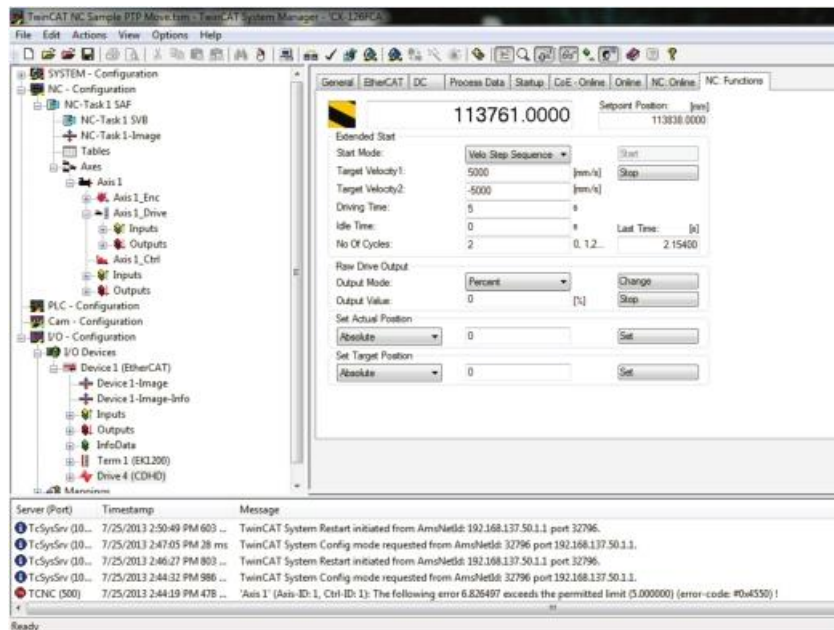


Figure 4-35.

The graph in the following figure reflects the motion performed:



Figure 4-36.

- Brown line = Position feedback – PFB
- Dark green line = Point to point generator velocity command – PTPVCMD
- Light green line = Velocity – V
- X axis = milliseconds, Y axis = counts

5 CANopen Operation

5.1 Device Communication

The BDHDE communication interface conforms to the following standards:

- **CiA 301:** CANopen Application Layer and Communication Profile
- **IEC 61800-7-1:** Interface Definition; (previously CiA 402-1: General Definitions)
- **IEC 61800-7-201:** Profile Type 1 (CiA 402); (previously CiA 402-2: Operation Modes and Application Data)
- **IEC 61800-7-301:** Mapping of Profile Type 1; (previously CiA 402-3: PDO Mapping)

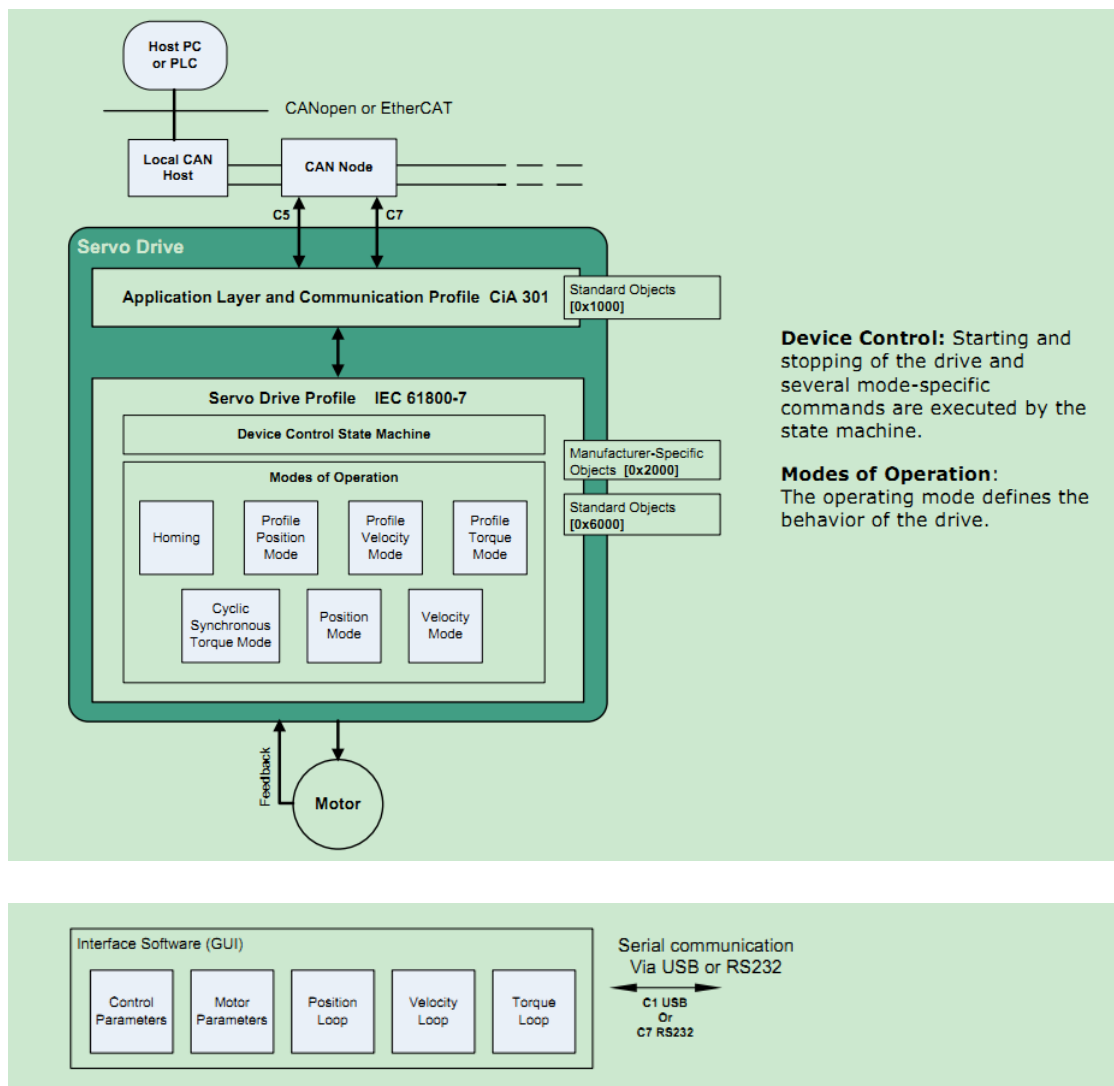


Figure 5-1. Communication Architecture

5.2 Communication Objects

Communication objects are used for exchanging process and service data, for process or system time synchronization, for error state supervision, and for control and monitoring of node states. These objects are defined by their structure, transmission types and their CAN identifier.

5.2.1 Service Data Communication

Service data objects (SDOs) provide direct access to object entries in the CANopen device object dictionary. As these object entries contain data of arbitrary size and data type, the SDOs are used to transfer multiple data sets (each containing an arbitrary large block of data) from a client to a server and vice versa. The client controls, via a multiplexer (index and sub-index of the object dictionary), which data set is transferred. The content of the data set is defined within the object dictionary.

In general, an SDO is transferred as a sequence of segments. Prior to transferring the segments there is an initialization phase in which client and server prepare for transferring the segments. For SDOs, it is also possible to transfer a data set of up to four bytes during the initialization phase. This mechanism is called SDO expedited transfer.

The client always initiates an SDO transfer for any type of transfer. The owner of the accessed object dictionary is the server of the SDO. Either the client or the server can take the initiative to abort the transfer of an SDO.

By means of an SDO, a peer-to-peer communication channel between two CANopen devices is established. A CANopen device supports more than one SDO. One supported Server-SDO is the default case (Default SDO).

5.2.2 Process Data Communication

Process data objects (PDOs) perform real-time data transfer. The transfer of PDOs is performed without any protocol overhead.

The PDOs correspond to objects in the object dictionary and provide the interface to the application objects. Data type and mapping of application objects into a PDO is determined by a corresponding default PDO mapping structure within the object dictionary. BDHDE supports variable PDO mapping; therefore, the number of PDOs and the mapping of application objects into a PDO may be transmitted to a CANopen device during the configuration process, by applying the SDO services to the corresponding objects of the object dictionary.

PDOs are used for both data transmission and data reception – termed Transmit-PDO (TPDO) and Receive-PDO (RPDO), respectively. CANopen devices supporting TPDO are PDO producers, and CANopen devices supporting RPDO are called PDO consumers. BDHDE supports both. The PDO communication parameter describes the communication capabilities of the PDO. The PDO mapping parameter contains information about the contents of the PDO.

For each PDO, a pair of communication and mapping parameters is mandatory. By default 4 TPDOs and 4 RPDOs are implemented in the BDHDE:

TPDO1-1A00h

- Status word (6041h), 16 bits
- Actual position (6064h), 32 bits
- Actual velocity (606Ch), 32 bits
- Actual torque (6077h), 16 bits
- Modes of operation display (6061h), 8 bits
- Following error (60F4h), 32 bits
- Touch probe status (60B9), 16 bits
- Touch probe value (60BA), 32 bits

TPDO2-1A01h

- Status word (6041h), 16 bits
- Position actual value (6064h), 32 bits

TPDO3-1A02h

- Status word (6041h), 16 bits
- Actual velocity (606Ch), 32 bits

TPDO4-1A03h

- Status word (6041h), 16 bits
- Actual torque(6077h), 16 bits

RPDO1-1600h

- Target position (607Ah), 32 bits
- Target velocity (60FFh), 32 bits
- Modes of operation (6060h), 8 bits
- Control word (6040h), 16 bits
- Profile velocity (6081h), 32 bits
- Touch probe function (60B8), 16 bits
- Target torque (6071h), 16 bits
- Profile acceleration (6083h), 32 bits

RPDO2-1601h

- Control word (6040h), 16 bits
- Target position (607Ah), 32 bits

RPDO3-1602h

- Control word (6040h), 16 bits
- Target velocity (60FFh), 32 bits

RPDO4-1603h

- Control word (6040h), 16 bit
- target torque (6071h), 16 bit

5.3 Device Control and State Machine

The power drive system finite-state automaton (PDS FSA) is a mathematical model that defines the behavior of the power drive system. Because a power drive system is required to provide local control even when the communication network is not functioning properly, the communication FSA and the PDS FSA are only loosely coupled. Figure shows how the power drive system operates remotely via the network, or locally.

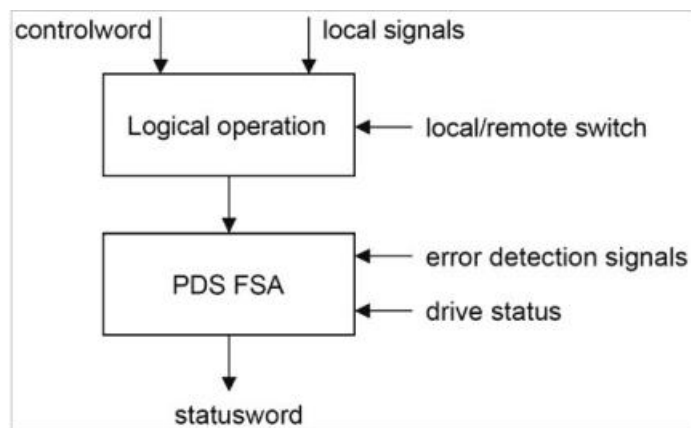


Figure 5-2. Remote and Local Control

The power drive system is operated by the **Controlword** sent by the control device via the network. The state of the power drive system is reported by the **Statusword** produced by the drive device. The FSA is also controlled by error detection signals.

The PDS FSA defines the power drive system status and the possible control sequence of the power drive system. A single state represents a special internal or external behavior. The state of the power drive system also determines which commands are accepted. For example, it is only possible to start a point-to-point move when the drive is in the operation enabled state.

5.4 Indicating the Operating State

After switching on, and when an operating mode is started, the power drive system goes through a number of operating states. The operating states are internally monitored and influenced by monitoring functions

Figure 7-3 illustrates the PDS FSA behavior. It takes into consideration the control of the power electronics, in accordance with user commands and internal drive faults.

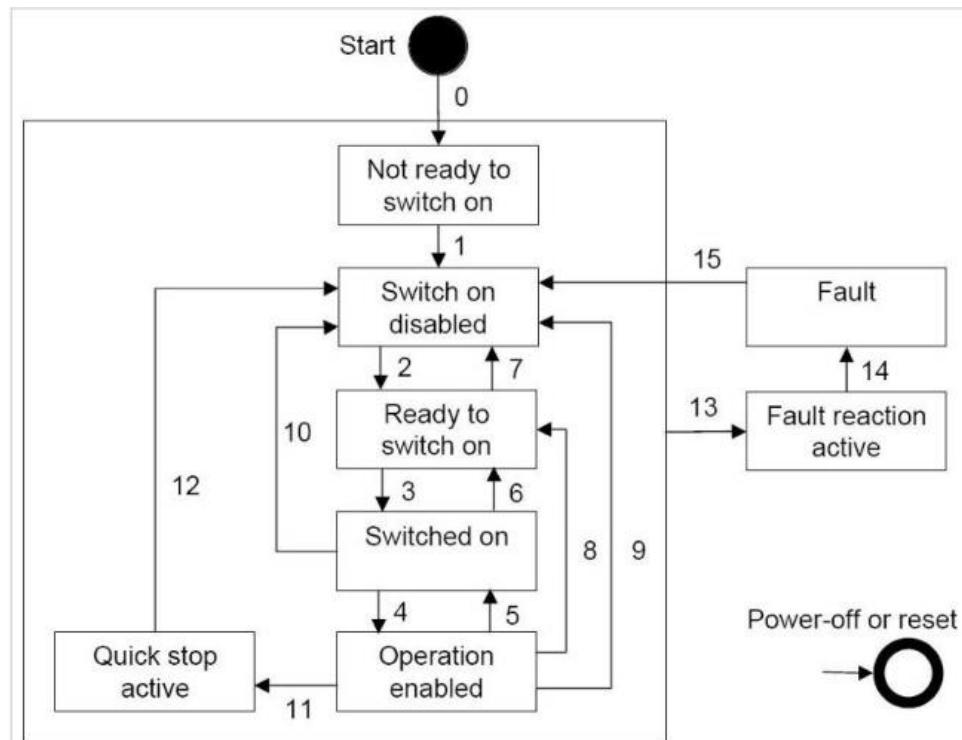


Figure 5-3. Power Drive System State Diagram

Notes:

Not Ready to Switch On	"Not ready to operate" received from the controller.
Switch On Disabled	Ready to operate. Can read and write parameters. Motion functionality cannot be executed.
Ready to Switch On	Ready to operate. Can read and write parameters. Motion functionality cannot be executed. Bus voltage must be switched on.
Operation Enabled	Drive power stage is enabled. No fault is present. Motion functionality can be executed.
Quick Stop Active	Drive was stopped using controlled stop. Power stage is enabled. Motion functionality cannot be executed.
Fault Reaction Active	A fault has occurred. Drive is in the process of ramping down to 0 velocity (Active Disable process).
Fault	A fault has occurred. Power stage is disabled.

Bits 0, 1, 2, 3, 5 and 6 of the parameter Statusword provide information on the operating state.

Operating State	Bit 6: Switch On Disabled	Bit 5: Quick Stop	Bit 3: Fault	Bit 2: Operation Enabled	Bit 1: Switch On	Bit 0: Ready to Switch On
2 Not Ready To Switch On	0	X	0	0	0	0

3	Switch On Disabled	1	X	0	0	0	0
4	Ready To Switch On	0	1	0	0	0	1
5	Switched On	0	1	0	0	1	1
6	Operation Enabled	0	1	0	1	1	1
7	Quick Stop Active	0	0	0	1	1	1
8	Fault Reaction Active	0	X	1	1	1	1
9	Fault	0	X	1	0	0	0

Parameter Name	Bit Assignments	Data Type R/W
Statusword	Bits 0–3 = Status bits Bit 4 = Voltage enabled Bits 5–6 = Status bits Bit 7 = Warning Bit 8 = Reserved Bit 9 = Remote Bit 10 = Target reached Bit 11 = Internal limit is active Bit 12 = Operating mode-specific Bit 13 = Operating mode-specific Bit 14 = Manufacturer-specific Bit 15 = Manufacturer-specific	Unsigned16 Read Only

Notes:

- Bit 4 Bit 4=1 indicates whether the DC bus voltage is correct. If the voltage is missing or is too low, the device does not transition from operating state 3 to operating state 4.
- Bit 7 If bit 7 (warning) of the status word is 1, it indicates the presence of a warning condition. Warning is not an error or fault (e.g., temperature limit exceeded, job refused). The status of the PDS FSA does not change. The cause of the warning may be given in the fault code parameter object (603Fh).
- Bit 9 If bit 9 is set, the device carries out commands via the fieldbus. If Bit 9 is reset, the device is controlled via a different interface. In such a case, it is still possible to read or write parameters via the fieldbus.
- Bit 10 Bit 10 is used for monitoring the current operating mode.
- Bit 12 Bit 12 is used for monitoring the current operating mode.
- Bit 13 Bit 13 only becomes 1 if an error needs to be resolved prior to further processing.

5.5 Changing the Operating State

The parameter Controlword can be used to switch between operating states.

Parameter Name	Bit Assignments	Data Type R/W
Controlword	Bit 0 = Switch On Bit 1 = Enable Voltage Bit 2 = Quick Stop Bit 3 = Enable Operation Bits 4–6 = Operating Mode specific Bit 7 = Fault Reset Bit 8 = Halt Bit 9 = Reserved Bits 10–15 = Reserved (must be 0) Changed settings become active immediately.	Unsigned16 Read Only

Bits 0, 1, 2, 3 and 7 of the parameter Controlword allow you to switch between the operating states.

Fieldbus Command	State Transitions	State Transition To	Bit 7: Fault Reset	Bit 3: Enable Operate	Bit 2: Quick Stop	Bit 1: Enable Voltage	Bit 0: Switch On
Shutdown	T2, T6, T8	4 – Ready To Switch On	X	X	1	1	0
Switch On	T3	5 – Switched On	X	X	1	1	1
Disable Voltage	T7, T9, T10, T12	3 – Switch On Disabled	X	X	X	0	X
Quick Stop	T7, T10 T11	3 – Switch On Disabled 7 – Quick Stop Active	X	X	0	1	X
Disable Operation	T5	5 – Switched On	X	0	1	1	1
Enable Operation	T4, T16	6 – Operation Enabled	X	1	1	1	1
Fault Reset	T15	3 – Switch On Disabled	0 » 1	X	X	X	X

Notes:

Bit 4–6 Bits 4 to 6 are used for the operating mode-specific settings.

Bit 8 A Halt can be triggered with bit 8=1.

Bit 9–15 Reserved.

5.6 Starting and Changing an Operating Mode

The parameter Mode of Operation (6060h) is used to set the desired operating mode.

Parameter Name	Description	Data Type R/W
Mode of	Operating mode	Integer8

operation	1	Profile Position	Read/Write
	3	Profile Velocity	
	4	Profile Torque	
	6	Homing	
	7	(not supported)	
	8	Cyclic Synchronous Position	
	9	Cyclic Synchronous Velocity	
	10	Cyclic Synchronous Torque	
	Changed settings become active immediately.		

The parameter Mode of operation display (6061h) can be used to read the current operating mode.

Parameter Name	Description	Data Type R/W
Mode of operation	Operating mode	Integer8
	1 Profile Position	Read/Write
	3 Profile Velocity	
	4 Profile Torque	
	6 Homing	
	7 (not supported)	
	8 Cyclic Synchronous Position	
	9 Cyclic Synchronous Velocity	
	10 Cyclic Synchronous Torque	
	Changed settings become active immediately.	

5.7 Profile Position Mode

Description

In the operating mode Profile Position, a movement to a desired target position is performed.

Procedure

- Set [Mode of operation (6060h)] to operating mode Profile position (1).
- Set [Target position (607Ah)] to the target position (unit = pulse).
- Set [Profile velocity (6081h)] to profile velocity (unit = pulses per second).
- Set [Controlword (6040h)] to start the movement.
- Query [Position actual value (6064h)] to get the actual position of the motor.
- Query [Statusword (6041h)] to get the current status of following error, set- point acknowledge and target reached.

Optional

Additional information on the operating mode Profile Position:

- Query [Position demand value (6062h)] to get the internal reference value (unit = pulse).
- Query [Position actual value (6063h)] to get the actual position value (unit = increments).

Following error:

- Set [Following error window (6065h)] to the permissible following error (unit = pulse).
- Query [Following error actual value (60F4h)] to get the current following error (unit = pulse).

Standstill window:

- Set [Position window (6067h)] to the value for the standstill window. If the difference between the target position and the current motor position remains in the standstill window for the time Position window time (6065h), the target position is considered to have been reached (unit = pulse).
- Set [Position window time (6068h)] to the value for the standstill window. If the difference between the target position and the current motor position remains in the standstill window for the time Position window time (6065h), the target position is considered to have been reached (unit = pulse).

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of operation	No	Integer8	Immediately
6061h	0	Modes of operation display	No	Integer8	-
6062h	0	Position demand value	No	Integer32	-
6063h	0	Position actual value	No	Integer32	-
6064h	0	Position actual value	T_PDO	Integer32	-
6065h	0	Following error window	No	Unsigned32	-
6067h	0	Position window	No	Unsigned32	-
6068h	0	Position window time	No	Unsigned16	Immediately
6081h	0	Profile velocity	R_PDO	Unsigned32	Next movement
6091h	1	Numerator	R_PDO	Unsigned32	-
6092h		(Position factor)			
6091h	2	Speed constant (Position	R_PDO	Unsigned32	-
6092h		factor)			
60F4h	0	Following error actual value	No	Integer32	-
60FCh	0	Position demand value	No	Integer32	-

Example: Profile Position

Starting the Operating Mode

The operating mode must be set in the parameter Mode of operation (6060h). Writing the parameter value activates the operating mode. The movement is started via the Controlword.

Controlword

Bits 4–6 and bit 8 in the parameter Controlword (6040h) start a movement.

Bit 5: Change Set Point Immediately	Bit 4: New Target Value	Meaning
0	0 » 1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are executed at the target. The movement is stopped at the current target position.*
1	0 » 1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are executed at the target. The movement is not stopped at the current target position.*

* Note: Target values include target position, target velocity, acceleration and deceleration.

Parameter Value	Meaning
Bit 6 = Absolute / relative	0: Absolute movement 1: Relative movement
Bit 8 = Halt	Stop movement with Halt

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Target position reached
- Stop caused by Halt or Quick Stop
- Stop caused by an error

Statusword

Information on the current movement is available via bits 10 and 12–15 in the parameter Statusword (6041h).

Parameter Value	Meaning
Bit 10 = Target reached	0 = Target position not reached 1 = Target position reached
Bit 12 = Target value acknowledge	0 = New position possible 1 = New target position accepted
Bit 13 = Following error bit	0 = No following error 1 = Following error
Bit 14 = Manufacturer-specific	
Bit 15 = Manufacturer-specific	

5.8 Homing Mode

Description

In the operating mode Homing, a movement is performed to a defined position. This position is defined as the reference point.

Procedure

- Set [Mode of operation (6060h)] to operating mode Homing (6).
- Set [Home offset (607Ch)].
- Set [Home method (6098h)], the value range is 1 to 35 and specifies the different homing methods.
- Set [Home speeds (6099h sub-index 1)] to the value for velocity for the search for the limit switches.
- Set [Home speeds (6099h sub-index 2)] to the value for velocity for the search for the index pulse.
- Set [Home acceleration (6099h sub-index 2)] to the value for the acceleration ramp.
- Set [Controlword (6040h)] to start the operating mode.
- Start Homing.
- Query [Statusword (6041h)] to get the device status.

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of operation	No	Integer8	Immediately

6061h	0	Modes of operation display	No	Integer8	-
607Ch	0	Home offset	No	Integer32	Next movement
6098h	0	Homing method	No	Integer8	Next movement
6099h	1	Speed during search for switch	No	Unsigned32	Next movement
6099h	2	Speed during search for zero	No	Unsigned32	Next movement
609Ah	0	Homing acceleration	No	Unsigned32	Next movement

Example: Homing

Starting the Operating Mode

The operating mode must be set in the parameter Mode of operation (6060h). Writing the parameter value activates the operating mode.

The movement is started via the Controlword.

Controlword

Bits 4 in the parameter Controlword (6040h) starts a movement, bit 8 terminates the movement.

Parameter Value	Meaning
Bit 4 = Homing operation start	Start Homing
Bit 5 = Reserved	Not relevant for this operating mode
Bit 6 = Reserved	Not relevant for this operating mode
Bit 8 = Halt	Stop movement with Halt

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Homing successful
- Stop caused by Halt or Quick Stop
- Stop caused by an error

Statusword

Information on the current movement is available via bits 10 and 12–15 in the parameter Statusword (6041h).

Parameter Value	Meaning
Bit 10 = Target reached	0 = Homing not completed

	1 = Homing completed
Bit 12 = Homing attained	1 = Homing successfully completed
Bit 13 = Homing error	1 = Homing error
Bit 14 = Manufacturer-specific	
Bit 15 = Manufacturer-specific	

5.9 Profile Velocity Mode

Description

In the operating mode Profile Velocity, a movement is made with a desired target velocity.

Procedure

- Set [Mode of operation (6060)] to operating mode Profile Velocity (3).
- Set [Controlword (6040h)] to start the operating mode.
- Set [Target velocity (60FFh)] to the target velocity. If the power stage is enabled, the new target velocity will become active immediately and the movement will start. The value is reset to zero if the operating mode is changed, the power stage is disabled or a Quick Stop is triggered.
- Query [Statusword (6041h)] to get the device status.

Optional

- Query [Velocity demand value (606Bh)] to get the reference velocity.
- Query [Velocity actual value (60C3h)] to get the actual velocity.
- Set [Velocity window (606Dh)] to the value of the velocity window.
- Set [Velocity window time (606Eh)] to the duration in the velocity window required to consider the velocity to have been reached.
- Query [Velocity threshold (60F4h)] to set the standstill window.

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of Operation	No	Integer8	Immediately
6061h	0	Modes of Operation Display	No	Integer8	-
606Bh	0	Velocity Demand Value	No	Integer32	-

606Ch	0	Velocity Actual Value	No	Integer32	-
606Dh	0	Velocity Window	No	Unsigned16	Immediately
606Eh	0	Velocity Window Time	No	Unsigned16	Immediately
606Fh	0	Velocity Threshold	No	Unsigned16	Immediately
60FFh	0	Target Velocity	No	Integer32	Immediately

Example: Profile Velocity

Starting the Operating Mode

The operating mode must be set in the parameter Mode of operation (6060h). Writing the parameter value activates the operating mode.

The parameter Target velocity (60FFh) starts the movement.

Parameter Name	Description	Data Type R/W
Target Velocity	Target velocity for operating mode Profile Velocity Changed settings become active immediately.	Integer32 Read/Write

Controlword

Bit 8 in parameter Controlword (6040h) is used to stop a movement with Halt.

Parameter Value	Meaning
Bit 4 = Reserved	Not relevant for this operating mode
Bit 5 = Reserved	Not relevant for this operating mode
Bit 6 = Reserved	Not relevant for this operating mode
Bit 8 = Halt	Stop movement with Halt
Bit 9 = Reserved	Not relevant for this operating mode

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by Halt or Quick Stop
- Stop caused by an error

Statusword

Information on the current movement is available via bits 10 and 12 in the parameter Statusword (6041h).

Parameter Value	Meaning
Bit 10 = Target reached	0 = Target velocity not reached

	1 = Target velocity reached
Bit 12 = Velocity	0 = Velocity > 0 1 = Velocity = 0
Bit 14 = Manufacturer-specific	
Bit 15 = Manufacturer-specific	

5.10 Profile Torque Mode

Description

In the operating mode Profile Torque, a movement is made with a desired target torque.

Procedure

- Set [Mode of operation (6060)] to operating mode Profile Torque (4).
- Set [Controlword (6040h)] to start the operating mode.

When the operating mode is started, the target torque is set to zero.

- Query [Motor rated current (6075)] to a value according to motor specifications (unit = mA).
- Set [Target torque (6071h)] to the value for the target torque (unit = 0.1% of nominal torque. The value is reset to zero if the operating mode is changed, the power stage is disabled or a Quick Stop is triggered).

Optional

- Query [Torque rated current (6075h)] to get the nominal current depending on the motor and the drive (unit = multiples of mA).
- Query [Current actual value (6078h)] to get the actual current (unit = increments of 0.1 % of the nominal current).

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of Operation	No	Integer8	Immediately
6061h	0	Modes of Operation Display	No	Integer8	-
6071h	0	Target Torque	R_PDO	Integer16	Immediately
6074h	0	Torque demand value	No	Integer16	-
6075h	0	Motor rated current	No	Unsigned32	-

6087h	0	Torque slope	R_PDO	Unsigned32	Immediately
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Example: Profile Torque

Starting the Operating Mode

The operating mode must be set in the parameter Mode of operation (6060h). Writing the parameter value activates the operating mode.

The parameter Target torque (6071h) starts the movement.

Parameter Name	Description	Data Type R/W
Target Torque	Target torque for operating mode Profile Torque. 100.0% corresponds to the continuous stall. In increments of 0.1%. Changed settings become active immediately.	Integer16 Read/Write

Controlword

Bit 8 in parameter Controlword (6040h) is used to stop a movement with Halt.

Parameter Value	Meaning
Bit 4 = Reserved	Not relevant for this operating mode
Bit 5 = Reserved	Not relevant for this operating mode
Bit 6 = Reserved	Not relevant for this operating mode
Bit 8 = Halt	Stop movement with Halt
Bit 9 = Reserved	Not relevant for this operating mode

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by Halt or Quick Stop
- Stop caused by an error

Statusword

Information on the movement is available via bit 10 in the parameter **Statusword** (6041h).

Parameter Value	Meaning
Bit 10 = Target reached	0 = Target torque not reached 1 = Target torque reached

5.11 Cyclic Synchronous Position Mode

Description

In the operating mode Cyclic Synchronous Position, a movement to a target position is performed according to the value of the synchronous cyclic time.

Procedure

- Set [Mode of operation (6060h)] to operating mode Cyclic Synchronous Position Profile (8).
- Set [Target position (607Ah)] to the target position (unit = pulse).
- Set [Controlword (6040h)] to start the movement.
- Query [Position actual value (6064h)] to get the actual position of the motor.
- Query [Statusword (6041h)] to get the current status of following error, set- point acknowledge and target reached.

Optional

Additional information on the operating mode Profile Position:

- Query [Position demand value (6062h)] to get the internal reference value (unit = pulse).
- Query [Position actual value (6063h)] to get the actual position value (unit = increments).

Following error:

- Set [Following error window (6065h)] to the permissible following error (unit = pulse).
- Query [Following error actual value (60F4h)] to get the current following error (unit = pulse).

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of operation	R_PDO	Integer8	Immediately
6061h	0	Modes of operation display	T_PDO	Integer8	-
6062h	0	Position demand value	No	Integer32	-
6063h	0	Position actual value	No	Integer32	-
6064h	0	Position actual value	T_PDO	Integer32	-
6065h	0	Following error window	No	Unsigned32	-
6067h	0	Position window	No	Unsigned32	-

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6068h	0	Position window time	No	Unsigned16	Immediately
6091h	1&2	Gear (Position factor)	No	Unsigned32	Immediately
6092h	1&2	Feedback constant (Units resolution factor)	No	Unsigned32	Immediately
60F2h	0	Position option code	No	Unsigned16	Next movement
60F4h	0	Following error actual value	T_PDO	Integer32	-
60FCh	0	Position demand internal value	No	Integer32	-

Example: Cyclic Synchronous Position Profile

Starting the Operating Mode

The operating mode must be set in the parameter Mode of Operation (6060h). Writing the parameter value activates the operating mode. The movement is started via the Controlword.

Controlword

Bit 4 in the parameter Controlword (6040h) start a movement.

Bit 4: New Target Value	Meaning
0 » 1	Starts a movement to a target position. Target values transmitted during a movement every tick times according to the synchronous time value. The movement is stopped at the desired target position.

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Target position reached
- Stop caused by Quick Stop
- Stop caused by an error

Statusword

Statusword does not change during movement when in operating in Cyclic Synchronous Position Profile mode.

5.12 Cyclic Synchronous Velocity Mode

Description

In the operating mode Cyclic Synchronous Velocity, a movement to a desired target velocity is performed according to the value of the synchronous cyclic time.

Procedure

- Set [Mode of operation (6060h)] to operating mode Cyclic Synchronous Velocity Profile (9).
- Set [Target velocity (60FFh)] to the target velocity. If the power stage is enabled, the new target velocity will become active immediately and the movement will start.
- Set [Controlword (6040h)] to start the movement.
- Query [Statusword (6041h)] to get the current status of following error, set-point acknowledge and target reached.

Optional

Additional information on the operating mode cyclic synchronous velocity:

- Query [Velocity demand value (606Bh)] to get the reference velocity.
- Query [Velocity actual value (60C3h)] to get the actual velocity.
- Set [Velocity window (606Dh)] to the value of the velocity window.
- Set [Velocity window time (606Eh)] to the duration required in the velocity window to consider the velocity has been reached (unit = milliseconds).
- Query [Velocity threshold (60F4h)] to set the standstill window.

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of Operation	R_PDO	Integer8	Immediately
6061h	0	Modes of Operation Display	T_PDO	Integer8	-
606Bh	0	Velocity Demand Value	No	Integer32	-
606Ch	0	Velocity Actual Value	T_PDO	Integer32	-
606Dh	0	Velocity Window	No	Unsigned16	Immediately
606Eh	0	Velocity Window Time	No	Unsigned16	Immediately
606Fh	0	Velocity Threshold	No	Unsigned16	Immediately
60FFh	0	Target Velocity	R_PDO	Integer32	Immediately

Example: Cyclic Synchronous Velocity

Starting the Operating Mode

The operating mode must be set in the parameter Mode of operation (6060h). Writing the parameter value activates the operating mode.

The parameter Target velocity (60FFh) starts the movement.

Parameter Name	Description	Data Type R/W
Target Velocity	Target velocity for operating mode Cyclic Synchronous Velocity Changed settings become active immediately.	Integer32 Read/Write

Controlword

Bit 8 in parameter Controlword (6040h) is used to stop a movement with Halt.

Parameter Value	Meaning
Bit 4 = Reserved	Not relevant for this operating mode
Bit 5 = Reserved	Not relevant for this operating mode
Bit 6 = Reserved	Not relevant for this operating mode
Bit 8 = Halt	Stop movement with Halt
Bit 9 = Reserved	Not relevant for this operating mode

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by Halt or Quick Stop
- Stop caused by an error

Statusword

Statusword does not change during movement when in operating in Cyclic Synchronous Velocity mode.

5.13 Cyclic Synchronous Torque Mode

Description

In the operating mode Cyclic Synchronous Torque, a movement to a desired target torque is performed according to the value of the synchronous cyclic time.

Procedure

- Set [Mode of operation (6060h)] to operating mode Cyclic Synchronous Torque (10).

- Set [Target torque (6071h)] to the target torque. If the power stage is enabled, the new target torque will become active immediately and the movement will start.
- Set [Controlword (6040h)] to start the movement.
- Query [Statusword (6041h)] to get the current status of following error, set-point acknowledge and target reached.

Optional

Additional information on the operating mode cyclic synchronous velocity:

- Query [Torque rated current (6075h)] to get the nominal current depending on the motor and the drive (unit = multiples of mA).
- Query [Current actual value (6078h)] to get the actual current (unit = increments of 0.1% of the nominal current)

Associated Objects

Index	Sub-index	Object	PDO	Data Type	Takes Effect
6040h	0	Controlword	R_PDO	Unsigned16	Immediately
6041h	0	Statusword	T_PDO	Unsigned16	-
6060h	0	Modes of Operation	R_PDO	Integer8	Immediately
6061h	0	Modes of Operation Display	T_PDO	Integer8	-
6071h	0	Target Torque	R_PDO	Integer16	Immediately
6074h	0	Torque demand value	T_PDO	Integer16	-
6075h	0	Motor rated current	No	Unsigned32	-
6087h	0	Torque slope	No	Unsigned32	

Example: Cyclic Synchronous Torque

Starting the Operating Mode

The operating mode must be set in the parameter Mode of operation (6060h).

Writing the parameter value activates the operating mode. The parameter Target torque (6071h) starts the movement.

Parameter Name	Description	Data Type R/W
Target Torque	Target torque for operating mode cyclic synchronous torque. 100.0% corresponds to the continuous stall. In increments of 0.1%. Changed settings become active immediately.	Integer32 Read/Write

Controlword

Bit 8 in parameter Controlword (6040h) is used to stop a movement with Halt.

Parameter Value	Meaning
Bit 4 = Reserved	Not relevant for this operating mode
Bit 5 = Reserved	Not relevant for this operating mode
Bit 6 = Reserved	Not relevant for this operating mode
Bit 8 = Halt	Stop movement with Halt
Bit 9 = Change on setpoint	Not relevant for this operating mode

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by Halt or Quick Stop
- Stop caused by an error

Statusword

Statusword does not change during movement when in operating in Cyclic Synchronous Torque mode.

5.14 Digital Output Operation

The following procedure describes how to control a BDHDE digital output.

1. Enable the digital outputs to be controlled manually:
 - Set object 60FEh sub-index 2 to FFFFFFFFh

This gives you permission to write to all digital outputs.
2. Define the mode of a specific output as **idle** to give you (and not drive logic) manual control of the output.

For example, define digital output 2 as idle:

- Set object 209Ch sub-index 1 to value 2
 - Set object 209Ch sub-index 2 to value 0
3. Set the output state by writing to the object.

Digital output 2 is represented by bit 1 in object 60FE; therefore:

 - Set object 60FE sub-index 1 to 00002h.

5.15 Digital Input Operation

The following procedure describes how to read a BDHDE digital input state.

1. Define the mode of a specific input as **idle** to give you (and not drive logic) manual control of the output.

For example, define digital input 2 as idle:

- Set object 20E0h sub-index 1 to value 2
- Set object 20E0h sub-index 2 to value 0

3. Read the input state by read from the object.

Digital input 2 is represented by bit 1 in object 60FD; therefore:

- Read object 60FD.

6 Units

6.1 Units Overview

CiA and ETG standards provide two objects for setting the gear ratio and the feed constant conversion factors, each of which has two sub-indices.

These objects have four equivalent (VarCom) drive parameters, as shown in the following table.

CAN Object	VarCom | ServoStudio	Description
6092h, sub-index 1	PNUM: Feed Constant (Unit Conversion) Numerator	Conversion factors of the user-defined unit. Used to multiply the motor revolution (rotary motors) or the motor pitch (linear motors), according to motor type.
6092h, sub-index 2	PDEN: Feed Constant (Unit Conversion) Denominator	
6091h, sub-index 1	FBGMS: Fieldbus Gear Ratio – Motor Shaft Scaling	The conversion factor of the fieldbus device's motor shaft revolution.
6091h, sub-index 2	FBGDS: Fieldbus Gear Ratio – Drive Shaft Scaling	The conversion factor of the fieldbus device's drive shaft revolution.

You can modify the values by writing directly to the objects.

Alternately, you can use the **EtherCAT Units** pane in the ServoStudio **Motion Units** screen:

EtherCAT Units

Feed Constant Scaling Numerator	<input type="text" value="10000"/>
Feed Constant Scaling Denominator	<input type="text" value="1"/>
Fieldbus Gear Driving Shaft Scaling	<input type="text" value="1"/>
Fieldbus Gear Motor Shaft Scaling	<input type="text" value="1"/>

Figure 6-1. ServoStudio Motion Units | EtherCAT Units

6.2 Position Units

Position units are expressed by the following equation:

$$\frac{0x6091 \text{ sub-index1}}{0x6091 \text{ sub-index2}} \times \frac{0x6092 \text{ sub-index1}}{0x6092 \text{ sub-index2}} = \mathbf{1 \text{ motor revolution}}$$

For example:

$$6091\text{h sub-index 1} = 1048576$$

$$6091\text{h sub-index 2} = 1$$

$$6092\text{h sub-index 1} = 1$$

$$6092\text{h sub-index 2} = 1$$

Therefore:

$$\frac{1048576}{1} \times \frac{1}{1} = 1048576$$

That is, 1048576 position units = 1 motor revolution.

Position Resolution - Examples

Position resolution should be as high as possible; it must certainly be no less than the encoder resolution.

When the drive is operating in Synchronous Position mode, the controller sends the drive one position command per cycle.

Low Resolution

CAN Object	Parameter	Value
6092h, sub-index 1	PNUM - Feed Constant (Unit Conversion) Numerator	360
6092h, sub-index 2	PDEN - Feed Constant (Unit Conversion) Denominator	1

Let's assume the controller intends to move the motor at a slow speed of 60 rpm; that is, 1 revolution per second, or **360 degrees per second**.

A typical EtherCAT cycle time is 1 ms; thus, the controller divides 360 degrees by 1000, and sends a command every 1 ms. Since EtherCAT supports integers only, and 0.36 (360/1000) is not an integer, the following will result:

Cycle	1	2	3	4	5	6	..	..	n
Profile generator in controller	0.36	0.72	1.08	1.44	1.8	2.16	..	..
EtherCAT position command	0	0	1	0	0	2	..	..	INT(n 0.36)
Position command in drive in units of 10000 counts/rev	0	0	27	0	0	55	..	..	INT(n 0.36) 10000/360

From the table, it can be seen that the command will be updated, on average, only once every three cycles. As a result, the motor will move 27 encoder counts in one cycle and be stopped for two cycles, producing significant acoustic noise. Should the speed be lowered, the noise will become even more severe.

High Resolution

CAN Object	Parameter	Value
6092h, sub-index 1	PNUM - Feed Constant (Unit Conversion) Numerator	1
6092h, sub-index 2	PDEN - Feed Constant (Unit Conversion) Denominator	1

Let's assume the controller intends to move the motor at a slow speed of 60 rpm; that is, 1 revolution per second, or **360000 counts per second**.

A typical EtherCAT cycle time is 1 ms; thus, the controller divides 360000 counts by 1000, and sends a command every 1 ms. Since 360000/1000 equals the integer 360, the following will result:

Cycle #	1	2	3	4	5	6	..	..	n
Profile generator in controller	360	720	1080	1440	1800	2160	..	..
EtherCAT position command	360	720	1080	1440	1800	2160	..	..	INT(n 360)
Position command in drive in units of 10000 counts/rev	10	20	30	40	50	60	..	..	INT(n 360) 10000/360000

From the table, it can be seen that the command will be consistently updated at each cycle. Speed will remain constant and there will be no acoustic noise.

Position commands sent over EtherCAT have the advantage of being highly accurate, thereby improving system performance.

6.3 Velocity Units

Velocity units are expressed by the following equation:

$$\frac{0x6091 \text{ sub-index}1}{0x6091 \text{ sub-index}2} \times \frac{0x6092 \text{ sub-index}1}{0x6092 \text{ sub-index}2} = \mathbf{1 \text{ rps}}$$

For example:

$$6091\text{h sub-index } 1 = 1048576$$

$$6091\text{h sub-index } 2 = 1$$

$$6092\text{h sub-index } 1 = 1$$

$$6092\text{h sub-index } 2 = 1$$

Therefore:

$$\frac{1048576}{1} \times \frac{1}{1} = 1048576$$

That is, 1048576 velocity units = 1 rps.

6.4 Acceleration/Deceleration Units

Acceleration/deceleration units are expressed by the following equation:

$$\frac{0x6091 \text{ sub-index1}}{0x6091 \text{ sub-index2}} \times \frac{0x6092 \text{ sub-index1}}{0x6092 \text{ sub-index2}} = \mathbf{1 \text{ rps / s}}$$

For example:

6091h sub-index 1 = 1048576

6091h sub-index 2 = 1

6092h sub-index 1 = 1

6092h sub-index 2 = 1

Therefore:

$$\frac{1048576}{1} \times \frac{1}{1} = 1048576$$

That is, 1048576 acc/dec units = 1 rps/s.

6.5 Current Units

Current units are derived from object 6075h (Motor Rated Current), which is defined in mA.

After setting a value for 6075h, all other current-related objects must receive values defined in 1/1000 (one-thousandth) of 6075h.

For example: Assuming 6075h has a value of 20000 mA, then to set a value of 40000 mA for object 6073h (Max Current), write 2000 for object 6073h.

The calculation is: (2000 ÷ 1000) 20000 = 40000 mA

6.6 Torque Units

Torque units are derived from object 6076h (Motor Rated Torque), which is defined in mNm.

After setting a value for 6076h, all other torque-related objects must receive values defined in 1/1000 (one thousandth) of 6076h.

For example: Assuming 6076h has a value of 500 mNm, then to set a value of 100 mNm for object 6074h (Torque Demand), write 200 for object 6074h.

The calculation is: (200 ÷ 1000) 500 = 100 mNm

6.7 Setting Units - Examples

Rotary Motor

Setting Units to Represent Feedback Counts

Position = counts

Velocity = counts/sec

Acceleration = counts/sec²

CAN Object	Parameter	Value
6092h, sub-index 1	PNUM - Feed Constant (Unit Conversion) Numerator	Motor_Resolution
6092h, sub-index 2	PDEN - Feed Constant (Unit Conversion) Denominator	1
6091h, sub-index 1	FBGMS - Fieldbus Gear Ratio – Motor Shaft Scaling	1
6091h, sub-index 2	FBGDS - Fieldbus Gear Ratio – Drive Shaft Scaling	1

This example assumes that the feedback device (i.e., encoder) produces 10,000 counts per 1 motor revolution.

The Motor Resolution parameter (MENCRES) defines the resolution of the motor encoder, in number of lines per revolution of the motor for a rotary motor, and in number of lines per pitch for a linear motor.

When an incremental encoder is used, the number of encoder counts per revolution or pitch is obtained by multiplying Motor Resolution by 4.

Get the value of Motor Resolution, multiple by 4, and then enter the number as the value of object 6092, sub-index 1.

Operating Mode: Profile Position

1. Set Mode of Operation (6060h) to Profile Position mode (1).
2. Set the Target Position (607Ah) value (unit = **counts**).
If object 607Ah is **10,000**, the motor shaft will rotate 10,000 counts, which equals one revolution.
3. Set the Profile Velocity (6081h) value (unit = **counts** per second).
If object 6081h is **10,000**, the motor shaft speed will be 10,000 counts/sec (one revolution per second).
4. Set Controlword (6040h) to start the movement.

Operating Mode: Profile Velocity

1. Set Mode of Operation (6060h) to Profile Velocity mode (3).

2. Set Controlword (6040h) to start the operating mode.
3. Set the Target Velocity (60FFh) value.

If object 6081h is **10,000**, the motor shaft speed will be 10,000 counts/sec (one revolution per second).

If the power stage is enabled, the new target velocity will become active immediately and the movement will start. The value is reset to zero if the operating mode is changed, the power stage is disabled, or a quick stop is triggered.

7 Communication Objects

The following communication profile objects have been implemented in the BDHDE servo drives.

For more information, refer to the specific CAN documentation.

1000h – Device Type

Object Description

Index	1000
Description	Contains information about the device type and functionality. It is comprised of a 16-bit field that describes the device profile used, and a second 16-bit field that gives additional information about optional functionality of the device.
Object Code	Variable
Data Type	Unsigned32

Entry Description

Access	Constant
PDO Mapping	No
Default Value	0x00000192
Range	0 to 4294967295
Units	Not Applicable

1001h – Error Register

Object Description

Index	1001
Description	<p>An error register for the device.</p> <p>A field of 8 bits, each of which indicates a particular type of error. If a bit is set to 1, the specified error has occurred.</p> <p>Bit Description</p> <p>0 = Generic error</p> <p>1 = Current</p>

	2 = Voltage 3 = Temperature 4 = Communication error (overrun, error state) 5 = Device profile specific 6 = Reserved 7 = Manufacturer specific
Object Code	Variable
Data Type	Unsigned8

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0x0
Range	0x0 to 0xFF
Units	Not Applicable

1008h –Manufacturer Device Name**Object Description**

Index	1008
Description	Device name assigned by manufacturer.
Object Code	Variable
Data Type	Visible_String
Category	Optional

Entry Description

Access	Constant
PDO Mapping	No
Default Value	BDHDE(Hardware-dependent)
Range	Not Applicable
Units	Not Applicable

1009h –Manufacturer Hardware Version**Object Description**

Index	1009
Description	Device version assigned by manufacturer.
Object Code	Variable
Data Type	Visible_String
Category	Optional

Entry Description

Access	Constant
PDO Mapping	No
Default Value	Not Applicable (depends on firmware)
Range	Not Applicable
Units	Not Applicable

100Ah –Manufacturer Software Version**Object Description**

Index	100A
Description	The version number of the manufacturer's software.
Object Code	Variable
Data Type	Visible_String
Category	Optional

Entry Description

Access	Constant
PDO Mapping	No
Default Value	Not Applicable (depends on firmware)
Range	Not Applicable
Units	Not Applicable

1018h –Identity Object**Object Description**

Index	1018
Description	Contains general information about the device.

	<p>Sub-index 1: Defines a unique value allocated to each manufacturer.</p> <p>Sub-index 2: Defines the manufacturer product code device version).</p> <p>Sub-index 3: Defines the revision number</p> <p style="padding-left: 20px;">Bit 31-16 = major revision number</p> <p style="padding-left: 20px;">Bit 15-0 = minor revision number</p> <p>Sub-index 4: Defines the manufacturer serial number.</p>
Object Code	Record
Data Type	Not Applicable
Category	Mandatory

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read Only
PDO Mapping	No
Default Value	4
Range	1 to 4
Units	Not Applicable
Sub-Index	001
Description	Vendor ID
Object Code	Variable
Data Type	Unsigned32
Category	Mandatory
Access	Read Only
PDO Mapping	No
Default Value	0x2E1
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Product code
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	0xBE2EB
Range	0x0 to 0xFFFFFFFF
Units	Not Applicable

Sub-Index	003
Description	Revision number
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	0
Range	0x0 to 0xFFFFFFFF
Units	Not Applicable

Sub-Index	004
Description	Serial number
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	0
Range	0x0 to 0xFFFFFFFF

Units	Not Applicable
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1600h – Receive PDO Mapping Parameter 1

Object Description

Index	1600
Description	<p>Contains the mapping for the PDOs the device is able to receive.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are received with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables. These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	8
Range	0 to 8
Units	Not Applicable
Sub-Index	001
Description	Mapping target position
Object Code	Variable

Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1618608160
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Mapping target velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1627324448
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	003
Description	Mapping modes of operation
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1616904200
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	004
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Description	Mapping controlword
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614807056
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	005
Description	Mapping profile velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1619066912
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	006
Description	Mapping touch probe function
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1622671376
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	007
Description	Mapping target torque
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1618018320
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	008
Description	Mapping profile acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1619197984
Range	0 to 4294967295
Units	Not Applicable

1601h – Receive PDO Mapping Parameter 2

Object Description

Index	1601
Description	<p>Contains the mapping for the PDOs the device is able to receive.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are received with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables.</p>

	<p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 2
Units	Not Applicable

Sub-Index	001
Description	Mapping controlword
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614807056
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
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Description	Mapping target position
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1618608160
Range	0 to 4294967295
Units	Not Applicable

1602h – Receive PDO Mapping Parameter 3

Object Description

Index	1602
Description	<p>Contains the mapping for the PDOs the device is able to receive.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are received with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables.</p> <p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory

Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 2
Units	Not Applicable

Sub-Index	001
Description	Mapping controlword
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614807056
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Mapping target velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1627324448
Range	0 to 4294967295
Units	Not Applicable

1603h – Receive PDO Mapping Parameter 4

Object Description

Index	1603
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Description	<p>Contains the mapping for the PDOs the device is able to receive.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are received with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables.</p> <p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 2
Units	Not Applicable

Sub-Index	001
Description	Mapping controlword
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No

Default Value	1614807056
Range	0 to 4294967295
Units	Not Applicable
Sub-Index	002
Description	Mapping target torque
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1618018320
Range	0 to 4294967295
Units	Not Applicable

1A00h – Transmit PDO Mapping Parameter 1

Object Description

Index	1A00
Description	<p>Contains the mapping for the PDOs the device is able to transmit.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are transmitted with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables.</p> <p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	8
Range	0 to 8
Units	Not Applicable

Sub-Index	001
Description	Mapping status word
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614872592
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Mapping actual position
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1617166368
Range	0 to 4294967295

Units	Not Applicable
Sub-Index	003
Description	Mapping actual velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1617690656
Range	0 to 4294967295
Units	Not Applicable
Sub-Index	004
Description	Mapping actual torque
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1618411536
Range	0 to 4294967295
Units	Not Applicable
Sub-Index	005
Description	Mapping modes of operation display
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No

Default Value	1616969736
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	006
Description	Mapping following error
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1626603552
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	007
Description	Mapping touch probe status
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1622736912
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	008
Description	Mapping touch probe value
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Access	Read/Write
PDO Mapping	No
Default Value	1622802464
Range	0 to 4294967295
Units	Not Applicable

1A01h – Transmit PDO Mapping Parameter 2

Object Description

Index	1A01
Description	<p>Contains the mapping for the PDOs the device is able to transmit.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are transmitted with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables.</p> <p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 2

Units	Not Applicable
Sub-Index	001
Description	Mapping status word
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614872592
Range	0 to 4294967295
Units	Not Applicable
Sub-Index	002
Description	Mapping actual position
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1617166368
Range	0 to 4294967295
Units	Not Applicable

1A02h – Transmit PDO Mapping Parameter 3

Object Description

Index	1A02
Description	<p>Contains the mapping for the PDOs the device is able to transmit.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are transmitted with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information</p>

	<p>about the mapped application variables.</p> <p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 2
Units	Not Applicable
Sub-Index	001
Description	Mapping status word
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614872592
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Mapping actual velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1617690656
Range	0 to 4294967295
Units	Not Applicable

1A03h – Transmit PDO Mapping Parameter 3

Object Description

Index	1A02
Description	<p>Contains the mapping for the PDOs the device is able to transmit.</p> <p>Sub-index 0: Defines the number of valid entries in the mapping record. This number of entries is also the number of the application variables that are transmitted with the corresponding PDO.</p> <p>Sub-indices 1 to number of entries: Contain information about the mapped application variables.</p> <p>These entries describe the PDO contents by their index, sub-index and length. All three values are hexadecimal coded. The length entry defines the length of the object in bits.</p> <p>This parameter can be used to verify the overall mapping length. It is mandatory.</p>
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8

Category	Mandatory
Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 2
Units	Not Applicable

Sub-Index	001
Description	Mapping status word
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1614872592
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Mapping actual torque
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1618411536
Range	0 to 4294967295
Units	Not Applicable

1C00h –Sync Manager Communication Type

Object Description

Index	1018
Description	Up to 32 sync manager types can be described. The first four sync manager types are fixed, and the following can be configured to one of the first four types. The default configuration is the following: 1 mailbox receive 2 mailbox send 3 process data output 4 process data input
Object Code	Array
Data Type	Unsigned8

Entry Description

Sub-Index	000
Description	Number of entries
Access	Read Only
PDO Mapping	No
Default Value	4
Range	0 to 4

Sub-Index	001
Description	Sub-index 1
Data Type	Unsigned8
Access	Read Only
PDO Mapping	No
Default Value	1
Range	0 to 4

Sub-Index	002
Description	Sub-index 2
Data Type	Unsigned8
Access	Read Only
PDO Mapping	No

Default Value	2
Range	0 to 4
Sub-Index	003
Description	Sub-index 3
Data Type	Unsigned8
Access	Read Only
PDO Mapping	No
Default Value	3
Range	0 to 4
Sub-Index	004
Description	Sub-index 4
Data Type	Unsigned8
Access	Read Only
PDO Mapping	No
Default Value	4
Range	0 to 4

1C12h – Sync Manager 2 PDO Assignment

Object Description

Index	1C12
Description	Sync Manager 2 PDO Assignment
Note	Valid only for EtherCAT.
Object Code	Variable
Data Type	Unsigned16

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	5632

Range	5632 to 6143
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1C13h – Sync Manager 3 PDO Assignment

Object Description

Index	1C13
Description	Sync Manager 3 PDO Assignment
Note	Valid only for EtherCAT.
Object Code	Variable
Data Type	Unsigned16

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	6656
Range	6656 to 7167

8 Manufacturer-Specific Objects

2002h – Configuration Command

Object Description

Index	2002
Description	Performs a configuration sequence of the drive according to its internal parameters. Writing 01 initiates the configuration command.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	CONFIG

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	Not Applicable

2006h –Current Integral (KI) Gain

Object Description

Index	2006
Description	The current controller integral gain.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KCI

Entry Description

Access	Read/Write
PDO Mapping	No

Default Value	32500
Range	0 to 100000
Units	Not Applicable

2007h –Current Proportional (KP) Gain

Object Description

Index	2007
Description	The current controller proportional gain.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KCP

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	50000
Range	0 to 1000000
Units	Not Applicable

2010h –Velocity Loop Bandwidth

Object Description

Index	2010
Description	The velocity control loop bandwidth for the pole placement controller.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KVBW

Entry Description

Access	Read/Write
PDO Mapping	No

Default Value	27000
Range	0 to 1000000
Units	Hz

2011h –Warning Bits

Object Description

Index	2011
Description	Lists warnings, by bits. Since BDHDE warnings are 96 bits, they are split into three 32-bit segments. Refer to the section Warning Codes.
Object Code	Record
Data Type	Not Applicable
Category	Optional

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	3
Range	3
Units	Not Applicable
Sub-Index	001
Description	Lower 32 bits of warning (status) word.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only

PDO Mapping	No
Default Value	0
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Middle 32 bits of warning (status) word.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	003
Description	Upper 32 bits of warning (status) word.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 4294967295
Units	Not Applicable

2013h –Current CL VD

Object Description

Index	2013
Description	The voltage command to the D component.

Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	CLVD

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-300000 to 300000
Units	Not Applicable

2014h –Current CL VQ

Object Description

Index	2014
Description	The voltage command to the Q component.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	CLVQ

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-300000 to 300000
Units	Not Applicable

2016h –Electrical Position

Object Description

Index	2016
Description	The electrical angle position in 16-bit resolution.

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	ELECTANGLE

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	65536/electrical cycle

201Ch –Position Acceleration Feedforward to Current**Object Description**

Index	201C
Description	The position acceleration feedforward to current loop.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KPAFRC

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 2000
Units	Not Applicable

201Dh –Position Acceleration Feedforward**Object Description**

Index	201D
Description	The position acceleration feedforward.

Object Code	Variable
Data Type	Unsigned32
Category	Reserved
VarCom	KPAFRV

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	-
Units	Not Applicable

201Eh –Position Derivative (KD) Gain

Object Description

Index	201E
Description	The position controller derivative gain.
Object Code	Variable
Data Type	Unsigned32
Category	Reserved
VarCom	KPD

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	-
Units	Not Applicable

201Fh –Position Proportional Adaptive Gain

Object Description

Index	201F
Description	The position controller adaptive proportional gain.

Object Code	Variable
Data Type	Unsigned32
Category	Reserved
VarCom	KPE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	-
Units	Not Applicable

2020h –Position Integral (KI) Gain**Object Description**

Index	2020
Description	The position controller integrator gain.
Object Code	Variable
Data Type	Unsigned32
Category	Reserved
VarCom	KPI

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	-
Units	hertz (Hz)

2022h – Position Proportional (KP) Gain**Object Description**

Index	2022
Description	The position controller proportional gain.

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KPP

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	48000
Range	0 to 1200000
Units	Not Applicable

2023h –Position Velocity Feedforward**Object Description**

Index	2023
Description	The position controller velocity feedforward.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KPVFR

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1100
Units	Not Applicable

2025h –Velocity Feedforward Ratio**Object Description**

Index	2025
Description	The velocity feedforward ratio.

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KVFR

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1000
Range	0 to 1200
Units	Not Applicable

2026h –Velocity Integrator**Object Description**

Index	2026
Description	The velocity integral gain.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KVI

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	5
Range	0 to 200000000
Units	hertz (Hz)

2027h –Velocity Gain**Object Description**

Index	2027
Description	The velocity proportional gain.

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KVP

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	21
Range	0 to 1000000000
Units	Not Applicable

2028h –Mechanical Angle**Object Description**

Index	2028
Description	The position of the motor in revolutions.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	MECHANGLE

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	65536/electrical cycle

202Eh –Motor Foldback Status**Object Description**

Index	202E
Description	Motor foldback status.

	Indicates whether the motor foldback limit has dropped below the application current limits.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	MFOLD

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

202Fh –Motor Foldback Delay Time**Object Description**

Index	202F
Description	Motor foldback delay time. The time delay for motor foldback; foldback is the amount of time the system current can exceed 6075h (MICONTR) before the drive enters motor foldback state.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MFOLDD

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	3000
Range	0 to 2400000
Units	seconds (s)

2030h – Motor Foldback Disable

Object Description

Index	2030
Description	Motor foldback disable. Enables/disables motor foldback protection.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	MFOLDDIS

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

2031h –Motor Foldback Recovery Time

Object Description

Index	2031
Description	The recovery time for motor foldback.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MFOLDR

Entry Description

Access	Read only
PDO Mapping	No
Default Value	0
Range	0 to 1000000
Units	seconds (s)

2032h –Motor Foldback Time Constant**Object Description**

Index	2032
Description	The time constant for motor foldback.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MFOLDT

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	3000
Range	0 to 1200000
Units	seconds (s)

2033h –Motor Foldback Current**Object Description**

Index	2033
Description	The current limit derived from the motor foldback mechanism. Foldback condition occurs when 2033h (MIFOLD) goes below 6072h (ILIM).
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MIFOLD

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 300000

Units	A
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2034h –Motor Foldback Fault Threshold

Object Description

Index	2034
Description	The motor foldback fault threshold.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MIFOLDFTHRESH

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 300000
Units	A

2036h –Motor Peak Current

Object Description

Index	2036
Description	The peak rated current of the motor.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MIPEAK

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	11879
Range	100 to 300000

Units	A
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2037h –Rotor Inertia

Object Description

Index	2037
Description	The rotor inertia of a rotary motor.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MJ

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	490
Range	0 to 2000000000
Units	kg*m2*10-4

2038h – BMEF Constant

Object Description

Index	2038
Description	The motor BMEF constant.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MKE

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	29860
Range	0 to 500000

Units	Not Applicable
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2039h –Torque Constant

Object Description

Index	2039
Description	The motor torque constant.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MKT

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	321
Range	1 to 3000
Units	Nm/A

203Ah –Motor Inductance

Object Description

Index	203A
Description	The motor minimum line-to-line inductance.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	ML

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	6200
Range	0 to 1000000

Units	mh
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2043h – Commutation Offset

Object Description

Index	2043
Description	The feedback phase relative to the standard commutation table. It is used to compensate for feedback offset.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	MPHASE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	65535/Elec Cycle

2044h –Drive Temperature

Object Description

Index	2044
Description	The temperature of the drive power boards (Celsius degrees).
Object Code	Array
Data Type	Integer16
Category	Optional
VarCom	DRIVETEMP

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	Not applicable

Range	-100 to 200
Units	Celsius degrees (°C)

2046h –Disabling Mode

Object Description

Index	2046
Description	Defines if and how Disabling mode is used for stopping the motor.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	DISMODE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 5
Units	Not Applicable

204Ah –Active Disabling Speed Threshold

Object Description

Index	204A
Description	The velocity below which the motor is considered stopped by Active Disable.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	DISSPEED

Entry Description

Access	Read/Write
PDO Mapping	No

Default Value	10000
Range	0 to 200000
Units	rpm

204Bh – Active Disabling Time

Object Description

Index	204B
Description	The time delay after 0204Ah (DISSPEED) is reached until drive is disabled by Active Disabling.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	DISTIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	10
Range	0 to 6500
Units	millisecond (ms)

204Ch – Factory Restore

Object Description

Index	204C
Description	Restores all configuration variables to factory default settings. Write 01 to initiate the factory restore command.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FACTORYRESTORE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	Not applicable
Range	1234 to 1234
Units	Not Applicable

204Dh –Feedback Type

Object Description

Index	204D
Description	The type of motor feedback.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FEEDBACKTYPE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	1 to 19
Units	Not Applicable

204Eh –Velocity Loop Output Filter Parameter 1

Object Description

Index	204E
Description	Velocity loop output filter first parameter.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FILTHZ1

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	440
Range	1 to 3500
Units	hertz (Hz)

204Fh –Velocity Loop Output Filter Parameter 2

Object Description

Index	204F
Description	Velocity loop output filter second parameter.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FILTHZ2

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	2000
Range	1 to 3500
Units	hertz (Hz)

2050h –Velocity Loop Output Filter Mode

Object Description

Index	2050
Description	Defines the type of velocity loop output filter.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FILTMODE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	0 to 6
Units	Not Applicable

2051h – Foldback Status

Object Description

Index	2051
Description	Indicates whether the drive foldback limit (IFOLD 2069h) has dropped below the applications current limits (ILIM 6073h).
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FOLD

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

2066h – Current D Axis

Object Description

Index	2066
Description	In vector control, indicates the value perpendicular to 2067h (IQ).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	ID

Entry Description

Access	Read Only
PDO Mapping	Yes
Default Value	0
Range	-100000 to 100000
Units	milliampere (mA)

2067h – Current Q Axis**Object Description**

Index	2067
Description	In vector control, indicates the current for the torque. This value is perpendicular to 2066h (ID).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IQ

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-100000 to 100000
Units	milliampere (mA)

2068h –Current Feedforward LPF**Object Description**

Index	2068
Description	The corner frequency of a first-order filter of the feedforward low pass filter.
Object Code	Variable
Data Type	Unsigned16
Category	Optional

VarCom	IFFLPPHZ
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Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	80
Range	10 to 1000
Units	hertz (Hz)

2069h –Drive Foldback Current Limit**Object Description**

Index	2069
Description	The current limit derived from the foldback mechanism Foldback condition occurs when 2069h (IFOLD) goes below 6072h (ILIM).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IFOLD

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 300000
Units	milliampere (mA)

206Ah –Drive Foldback Fault Threshold**Object Description**

Index	206A
Description	The current threshold for declaring a fault due to foldback.
Object Code	Variable
Data Type	Unsigned32

Category	Optional
VarCom	IFOLDFTHRESH

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	3959
Range	0 to 300000
Units	milliampere (mA)

2070h –Input Inversion**Object Description**

Index	2070
Description	The inversion state of each digital input. The index should be written first. Then, writing the value executes the actual input inversion.
Object Code	Array
Data Type	Unsigned16
Category	Optional
VarCom	ININV

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Index
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 5
Units	Not Applicable

Sub-Index	002
Description	Value
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

2072h –Phase U Actual Current

Object Description

Index	2072
Description	The actual current at phase U (of UVW).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IU

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-100000 to 100000
Units	milliampere (mA)

2073h –Phase U Current Offset

Object Description

Index	2073
Description	The current offset of phase U (of UVW).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IUOFFSET

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-1000000 to 1000000
Units	milliampere (mA)

2074h –Phase V Actual Current

Object Description

Index	2074
Description	The actual current at phase V (of UVW).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IV

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-100000 to 100000
Units	milliampere (mA)

2075h –Phase V Current Offset

Object Description

Index	2075
Description	The current offset of phase V (of UVW).
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IVOFFSET

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-1000000 to 1000000
Units	milliampere (mA)

2076h – Zero Procedure Current

Object Description

Index	2076
Description	The current for the Zero procedure.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IZERO

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to DIPEAK
Units	milliampere (mA)

2078h – Negative Limit Switch Status

Object Description

Index	2078
Description	The state of the hardware limit switches as configured by the digital inputs, in the negative direction.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	LIMSWITCHNEG

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

2079h –Positive Limit Switch Status

Object Description

Index	2079
Description	The state of the hardware limit switches as configured by the digital inputs, in the positive direction.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	LIMSWITCHPOS

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

207Ah –Load to Motor Inertia Ratio**Object Description**

Index	207A
Description	The ratio of the load inertia to the motor inertia.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	LMJR

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 600000
Units	0.001

207Bh –Drive Peak Current**Object Description**

Index	207B
Description	The peak rated current of the drive (sinusoidal peak).
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	DIPEAK

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	11879(Hardware-dependent)
Range	0 to 100000(Hardware-dependent)
Units	milliampere (mA)

207Ch – Drive Continuous Current**Object Description**

Index	207C
Description	The continuous rated current for the drive (sinusoidal peak).
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	DICONT

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	3959(Hardware-dependent)
Range	0 to 100000(Hardware-dependent)
Units	milliampere (mA)

207Eh –Motor Poles**Object Description**

Index	207E
Description	The number of individual poles (not pairs) in the motor.
Object Code	Variable
Data Type	UNSIGNED16
Category	Optional
VarCom	MPOLES

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	5
Range	2 to 20
Units	poles

207Fh – Motor Resistance**Object Description**

Index	207F
Description	The motor resistance.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MR

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	2620
Range	0 to 75000
Units	Ohm*10 ⁻³

2082h – Current KCFF Gain**Object Description**

Index	2082
Description	The current controller feed-forward gain.
Object Code	Variable
Data Type	Unsigned32
Category	Reserved
VarCom	KCFF

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0 to 100
Range	0
Units	Not Applicable

2090h – Home Status**Object Description**

Index	2090
Description	Homing status.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	HOMESTATE

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	Not applicable
Range	0 to 20
Units	Not Applicable

209Bh – Output Inversion**Object Description**

Index	209B
Description	The inversion state of each digital output. The index should be written first. Then, writing the value executes the actual output inversion.
Object Code	Array
Data Type	Unsigned16

Category	Optional
VarCom	OUTINV

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Index
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 3
Units	Not Applicable

Sub-Index	002
Description	Value
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write

PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

209Ch – Output Mode

Object Description

Index	209C
Description	<p>Defines the function of each digital output.</p> <p>The index should be written first. Then, writing the value assigns the actual function to the corresponding output index.</p> <p>Function codes:</p> <ul style="list-style-type: none"> 0 = Idle 1 = Active (enabled) 2 = Brake Release Signal 3 = Alarm Any Fault 12 = In Position 23 = Homing Complete 26 = V COIN 29 = Servo Ready 31 = At Torque Limi
Object Code	Array
Data Type	Unsigned16
Category	Optional
VarCom	OUTMODE

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No

Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Output index
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	0
Range	1 to 3
Units	Not Applicable

Sub-Index	002
Description	Function code
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 31
Units	Not Applicable

20A1h – Over-Voltage Threshold

Object Description

Index	20A1
Description	The level for detection of a bus over-voltage condition.
Object Code	Variable

Data Type	Unsigned32
Category	Optional
VarCom	OVTHRESH

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	400000
Range	90000 to 500000
Units	millivolt (mV)

20A2h – Software Enable Status**Object Description**

Index	20A2
Description	Software enable status.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	SWEN

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

20ACh –Software Position Limit Mode**Object Description**

Index	20AC
Description	Enables/disables software position limits.
Object Code	Variable

Data Type	Unsigned16
Category	Optional
VarCom	POSLIMMODE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

20B5h – Position Error in Position Flag**Object Description**

Index	20B5
Description	Indicates whether the position error is within the allowed tolerance. 0 = Not in position 1 = In position
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	INPOS

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

20BAh – Remote Hardware Enable Status**Object Description**

Index	20BA
Description	Indicates the state of the external hardware enable input. 0 = Remote enable input off. 1 = Remote enable input on.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	REMOTE

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	1
Range	0 to 1
Units	Not Applicable

20CBh – Tamagawa Multi-Turn Reset**Object Description**

Index	20CB
Description	Resets the counter of a Tamagawa multi-turn encoder. Write 01 to initiate the command.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	TMTURNRESET

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

20CDh –Under-Voltage Mode**Object Description**

Index	20CD
Description	Defines how the drive will respond to an under-voltage fault: 0 = Latches fault immediately. 1 = Shows warning only (when disabled, does not display warning). 2 = Shows warning, then waits 20D0h (UVTIME) before the fault is latched (when disabled, does not display warning). 3 = Fault only if under-voltage exists and drive is enabled.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	UVMODE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 3
Units	Not Applicable

20CEh –Under-Voltage Recovery Mode**Object Description**

Index	20CE
Description	Defines how the drive will recover from an under-voltage fault: 0 = Recovers by toggling drive from disable to enable condition after the under-voltage condition clears. 1 = Automatically recovers when the under-voltage condition clears.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	UVRECOVER

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

20CFh – Under-Voltage Threshold**Object Description**

Index	20CF
Description	The level for detection of an under-voltage condition.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	UVTHRESH

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	100000
Range	90000 to 400000
Units	millivolt (mV)

20D0h – Under-Voltage Time**Object Description**

Index	20D0
Description	The length of time an under-voltage warning is displayed before it is latched in 20CDh (UVMODE) = 2.
Object Code	Variable
Data Type	Unsigned16
Category	Optional

VarCom	UVTIME
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Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	40
Range	0 to 10000
Units	milliseconds (ms)

20D1h – Bus Voltage (DC)**Object Description**

Index	20D1
Description	Drive bus voltage used for current controller design.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	VBUS

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	320000
Range	0 to 850000
Units	millivolt (mV)

20D6h – Velocity Filter Mode**Object Description**

Index	20D6
Description	Defines the type of filter for extracting a velocity signal from the position feedback: 0 = No filter 1 = First order filter

	2 = Observer type I 3 = Observer type II
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	VELFILTMODE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	0-3
Units	Not Applicable

20DFh – Zeroing Command**Object Description**

Index	20DF
Description	Activates Zeroing mode, which locks the rotor in place by passing a fixed current through two phases. This is useful for determining the commutation offset on motors that have a resolver or absolute encoder.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	ZERO

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not applicable

20E0h – Input Mode**Object Description**

Index	20E0
Description	<p>Defines the function of each digital input.</p> <p>The index should be written first. Then, writing the value assigns the actual function to the corresponding input index. Refer to VarCom INMODE for the complete list of modes.</p> <p>Function codes:</p> <ul style="list-style-type: none"> 0 = Idle 1 = Remote Enable 2 = Clear Faults 4 = Emergency Stop 5 = Positive Limit Switch 6 = Negative Limit Switch 8 = Home Switch 19 = Zero Clamp 24 = Gain Switch 26 = Homing Command 27 = Touch Probe 1 28 = Touch Probe 2 38 = JOG motor to positive direction at speed JOGSPD1 39 = JOG motor to negative direction at speed JOGSPD1
Object Code	Array
Data Type	Unsigned16
Category	Optional
VarCom	INMODE

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2

Units	Not Applicable
Sub-Index	001
Description	Input index
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 5
Units	Not Applicable
Sub-Index	002
Description	Function code
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	0 to 63
Units	Not Applicable

20EEh – Drive and Motor Maximum Velocity

Object Description

Index	20EE
Description	The maximum velocity for drive and motor combination
Object Code	Variable
Data Type	Integer32
Category	Optional

VarCom	VMAX
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Entry Description

Access	Read Only
PDO Mapping	No
Default Value	10
Range	10 to 9000
Units	rpm

20F0h –Drive and Motor Maximum Current**Object Description**

Index	20F0
Description	The maximum current limit for a drive and motor combination.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	IMAX

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	11879
Range	0 to 100000
Units	milliampere (mA)

2103h –Homing Command**Object Description**

Index	2103
Description	Starts the homing process.
Object Code	Variable
Data Type	Unsigned16
Category	Optional

VarCom	HOMECMD
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Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 255
Units	Not Applicable

2113h – Drive Ready**Object Description**

Index	2113
Description	Indicates whether the drive is ready for activation with only external remote enable switch still required.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	READY

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not Applicable

211Dh –Velocity Filter Pole Frequency**Object Description**

Index	211D
Description	Used to set the first order filter, which is applied to the velocity feedback signal before applying the velocity controller
Object Code	Variable

Data Type	Unsigned16
Category	Optional
VarCom	VELFILTRQ

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	440
Range	1 to 3500
Units	Hz

217Bh – Zero Motor Phase Degree

Object Description

Index	217B
Description	Returns the motor phase degree after a successful zeroing command.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	ZEROST

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 65535/Elec cycle
Units	-

2300h – Dob 2 Frequency

Object Description

Index	2300
Description	The disturb observer output filter cutoff frequency
Object Code	Variable

Data Type	Unsigned16
Category	Optional
VarCom	DOB2FREQ

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1000
Range	0 to 8000
Units	Hz

2301h – Dob 2 Load Gain**Object Description**

Index	2301
Description	The disturb observer output gain
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	DOB2GAIN

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 100
Units	1%

2302h – Dob 2 Load Ratio**Object Description**

Index	2302
Description	The ratio of the load inertia to the motor inertia used in the disturb observer.

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	DOB2LMJR

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 30000
Units	0.001

2303h – Electrical Gear Ratio Product Max

Object Description

Index	2303
Description	Electrical gear ratio product max
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	GEARTOTALMAX

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	8000000
Range	1 to 10000000
Units	Not applicable

2304h –Electrical Gear Ratio Product Min

Object Description

Index	2304
Description	Electrical gear ratio product min

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	GEARTOTALMIN

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	1
Range	1 to 10000000
Units	Not applicable

2305h – Iq Command Low Pass Filter Frequency**Object Description**

Index	2305
Description	Iq command low pass filter frequency
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	ICMDLPF

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	200
Range	0 to 8000
Units	Hz

2306h – Digital input filter time**Object Description**

Index	2306
Description	Digital input filter time

Object Code	Array
Data Type	Unsigned16
Category	Optional
VarCom	INFLTTIME

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Digital input index
Object Code	Variable
Data Type	Unsigned16
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1-5
Units	Not Applicable

Sub-Index	002
Description	Digital input filter time
Object Code	Variable
Data Type	Unsigned16

Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0-3
Units	ms

2310h – Current Loop anti-saturation gain

Object Description

Index	2310
Description	Current loop anti-saturation gain
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KCA

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	20
Range	0 to 100000
Units	Not applicable

2311h – Current Loop BEMF gain

Object Description

Index	2311
Description	Current loop BEMF gain
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KCBEMF

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	700
Range	0 to 1000
Units	Not applicable

2312h –Current Loop bandwidth**Object Description**

Index	2312
Description	Current loop bandwidth
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KCBW

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1200000
Range	0 to 5000000
Units	herz (Hz) *10 ⁻³

2313h – Current Loop global gain**Object Description**

Index	2313
Description	Current loop global gain
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KCGLOBALGAIN

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1000
Range	300 to 2000
Units	Not applicable

2314h –Positon Loop bandwidth**Object Description**

Index	2314
Description	Positon loop bandwidth
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KPBW

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	48000
Range	0 to 1000000
Units	herz (Hz)*10-3

2315h – Position Velocity Feedforward Low Pass Filter Frequency**Object Description**

Index	2315
Description	Position velocity feedforward low pass filter frequency
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KPVFRLPF

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	3000
Range	100 to 8000
Units	Hz

2316h – Position Velocity Feedforward Ratio**Object Description**

Index	2316
Description	Position velocity feedforward ratio
Object Code	Variable
Data Type	Unsigned32
Category	Reserved
VarCom	KPVFRR

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1000
Range	0 to 1000
Units	Not applicable

2317h –VelocityLoop Integral Time**Object Description**

Index	2317
Description	VelocityLoop integral time
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	KVTI

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	21000
Range	0 to 2000000
Units	microsecond(us)

2320h – Load estimation distance (rev)**Object Description**

Index	2320
Description	Load estimation distance
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	LOADESTDIST

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	2000
Range	1000 to 3000
Units	rev

2321h – Load estimation speed**Object Description**

Index	2321
Description	Load estimation speed
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	LOADESTMAXVEL

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	800000
Range	300000 to 1000000
Units	Not applicable

2322h – Load estimation status**Object Description**

Index	2322
Description	The status of load estimation
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	LOADESTSTATUS

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 6
Units	Not applicable

2323h – Load estimation command**Object Description**

Index	2323
Description	Load estimation command
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	LOADESTEN

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not applicable

2324h –Load estimation mode**Object Description**

Index	2324
Description	Load estimation mode 0: Run positive then negative 1: Run negative then positive 2: Run positive 3 Run negative
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	LOADESTMOTION

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 3
Units	Not applicable

2325h –Load estimation ratio**Object Description**

Index	2325
Description	Load estimation ratio
Object Code	Variable

Data Type	Unsigned32
Category	Optional
VarCom	LOADESTRATIO

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 100000
Units	Not applicable

2326h –Load estimation value**Object Description**

Index	2326
Description	Load estimation value
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	LOADESTVAL

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	172
Range	0 to 10000
Units	kg*m2*10-3

2327h –Motor Rated Power**Object Description**

Index	2327
Description	Motor rated power
Object Code	Variable

Data Type	Unsigned16
Category	Optional
VarCom	MPOWER

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	400000
Range	0 to 2000000(Hardware-dependent)
Units	watt(W)*10 ⁻³

2328h –Motor Rated Speed**Object Description**

Index	2328
Description	Motor rated speed
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	MRATEDSPEED

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	3000000
Range	0 to 6000000(Hardware-dependent)
Units	rpm*10 ⁻³

2329h –Out Brake Engage Time**Object Description**

Index	2329
Description	Brake Engage Time
Object Code	Variable

Data Type	Unsigned16
Category	Optional
VarCom	OUTBRAKEENGAGETIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	10
Range	0 to 6500
Units	millisecond (ms)

232Ah –Out Brake Release Time**Object Description**

Index	232A
Description	Brake Release Time
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	OUTBRAKERELEASETIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	500
Range	0 to 1000
Units	millisecond (ms)

232Bh –Out Brake Release Velocity**Object Description**

Index	232B
Description	Brake Release Velocity
Object Code	Variable

Data Type	Unsigned32
Category	Optional
VarCom	OUTBRAKESAFESPD

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	10
Range	0 to 200
Units	rpm

232Ch – Over-Velocity Threshold**Object Description**

Index	2330
Description	Over-Velocity Threshold
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	OVELTHRESH

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	7500
Range	1 to 11000
Units	rpm*10 ⁻³

232Dh – Phase Advance Factor**Object Description**

Index	232D
Description	This object indicates the factor of the phase advance as a function of velocity

Object Code	Variable
Data Type	Signed32
Category	Optional
VarCom	PAF

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0xBB8
Range	0x0 to 0x7FFFFFFF
Units	Not Applicable

232Eh – Phase Advance Limit**Object Description**

Index	232E
Description	This object indicates the limit of the phase advance in degrees.
Object Code	Variable
Data Type	Signed32
Category	Optional
VarCom	PAL

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0x46
Range	0x0 to 0x5A
Units	Deg

232Fh – Phase Advance Start Velocity**Object Description**

Index	232F
Description	This object indicates the limit of the phase advance in degrees.

Object Code	Variable
Data Type	Signed32
Category	Optional
VarCom	PASV

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0x0
Range	0x0 to 0x7FFFFFFF
Units	Rpm

2331h – Software Position Limit Minimum low 32bit**Object Description**

Index	2331
Description	Software position limit minimum low 32bit
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	POSLIMNEG

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0x0 to 0xFFFFFFFF
Units	count

2332h –Software Position Limit Minimum High 32bit**Object Description**

Index	2332
Description	Software position limit minimum high 32bit

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	POSLIMNEG2

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0xFFFFFFFFC0
Range	0x0 to 0xFFFFFFFF
Units	count

2333h – Software Position Limit Maximum low 32bit

Object Description

Index	2333
Description	Software position limit maximum low 32bit
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	POSLIMPOS

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0x0 to 0xFFFFFFFF
Units	count

2334h –Software Position Limit Maximum High 32bit

Object Description

Index	2334
Description	Software position limit maximum high 32bit

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	POSLIMPOS2

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0x3F
Range	0x0 to 0xFFFFFFFF
Units	count

2335h –Regeneration fault check enable**Object Description**

Index	2335
Description	Regeneration fault check enable
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	REGENCHECKENABLE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	0 to 1
Units	Not applicable

2336h – Regeneration Resistor Maximum On Time**Object Description**

Index	2336
Description	Regeneration resistor maximum on time

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	REGENMAXONTIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	40
Range	10 to 3000
Units	ms

2337h – Regeneration Resistor Maximum Power**Object Description**

Index	2337
Description	Regeneration resistor maximum power
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	REGENMAXPOW

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	100
Range	0 to 2000
Units	watt(w)

2338h – Regeneration Resistor Power**Object Description**

Index	2338
Description	Regeneration resistor power

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	REGENPOW

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	35
Range	0 to 2000
Units	watt(w)

2339h – Regeneration Resistor Resistance**Object Description**

Index	2339
Description	Regeneration Resistor Resistance
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	REGENRES

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	50
Range	0 to 1000
Units	Ohm

233Ah – Rigid Table**Object Description**

Index	233A
Description	Rigid table

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	RIGID

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	13
Range	0 to 31
Units	Not applicable

2340h – Save Parameters**Object Description**

Index	2340
Description	Save parameters
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	SAVE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	Not applicable
Range	Not applicable
Units	Not applicable

2341h – SOB Band Width**Object Description**

Index	2341
Description	SOB band width

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	SOBBW

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	100000
Range	2000 to 600000
Units	herz(Hz) * 10 ⁻³

2342h – SOB Inertia Compensation Coefficient**Object Description**

Index	2342
Description	SOB Inertia Compensation Coefficient
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	SOBJCOMPCOEF

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1000
Range	0 to 20000
Units	Not applicable

2343h –SOB Torque Input LPF Time Constant**Object Description**

Index	2343
Description	SOB Torque Input LPF Time Constant

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	SOBTINTC

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1000000
Units	microsecond (us)

2344h –SOB Torque Output LPF Time Constant**Object Description**

Index	2344
Description	SOB Torque Output LPF Time Constant
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	SOBTOUTTC

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	500
Range	0 to 1000000
Units	microsecond (us)

2345h –Velocity Feedback 2 of Speed Observer with RPM unit**Object Description**

Index	2345
Description	Velocity feedback 2 of speed observer with rpm unit

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	SOBVF BK2

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-10000000 to 10000000
Units	rpm

2346h – SOB Velocity Output Type**Object Description**

Index	2346
Description	SOB Velocity Output Type
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	SOBVF BKTYPE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	0 to 1
Units	Not applicable

2347h –Stall Time**Object Description**

Index	2347
Description	Stall Time

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	STALLTIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	350
Range	0 to 10000
Units	millisecond (ms)

2348h – Stall Velocity**Object Description**

Index	2348
Description	Stall Velocity
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	STALLVEL

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	60
Range	0 to 100
Units	rpm

2349h – Software Enable on Power-Up**Object Description**

Index	2349
Description	Software Enable on Power-Up

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	SWENMODE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not applicable

2350h –Tuning Auto Enable**Object Description**

Index	2350
Description	Auto tuning enable
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	TUNINGAUTOEN

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 1
Units	Not applicable

2351h –Tuning Adaptive level**Object Description**

Index	2351
Description	Adaptive tuning level

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	TUNINGLEVEL

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	2
Range	0 to 3
Units	Not applicable

2352h –Tuning Degree of The Load**Object Description**

Index	2352
Description	The load degree of tuning method
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	TUNINGLOAD

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 3
Units	Not applicable

2353h – Maximum Velocity Error**Object Description**

Index	2353
Description	Maximum Velocity Error

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	VEMAX

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 500
Units	rpm

2354h – Velocity Error Time**Object Description**

Index	2354
Description	Velocity Error Time
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	VETIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	100
Range	0 to 3000
Units	millisecond (ms)

2355h – Zero Clamp velocity threshold**Object Description**

Index	2355
Description	Zero Clamp velocity threshold

Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	ZCLAMPVEL

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	50
Range	1 to 3000
Units	rpm

9 Standard Servo Drive Objects

The following standard device profile objects are implemented in the BDHDE servo drives.

For more information, refer to the relevant CAN documentation.

603Fh – Error Code

Object Description

Index	603F
Description	Indicates the error code of the last error that occurred in the drive device.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	FLT

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

6040h – Controlword

Object Description

Index	6040
Description	<p>Sets the operating states and modes of the state machine.</p> <p>This object is organized bit-wise. The bits have the following meaning:</p> <p>Bit Description</p> <p>0 = switch on</p> <p>1 = enable voltage</p> <p>2 = quick stop</p>

	3 = enable operation 4-6 = mode-specific 7 = fault reset 8 = halt 9 = mode-specific 10 = reserved 11-15 = manufacturer-specific
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

6041h – Statusword**Object Description**

Index	6041																		
Description	<p>Indicates the current state of the FSA, the operation mode and manufacturer-specific entities.</p> <p>This object is organized bit-wise. The bits have the following meaning:</p> <table> <tr> <td>Bit</td> <td>Description</td> </tr> <tr> <td>0</td> <td>ready to switch on</td> </tr> <tr> <td>1</td> <td>switched on</td> </tr> <tr> <td>2</td> <td>operation enabled</td> </tr> <tr> <td>3</td> <td>fault</td> </tr> <tr> <td>4</td> <td>voltage enabled</td> </tr> <tr> <td>5</td> <td>quick stop</td> </tr> <tr> <td>6</td> <td>switch on disabled</td> </tr> <tr> <td>7</td> <td>warning</td> </tr> </table>	Bit	Description	0	ready to switch on	1	switched on	2	operation enabled	3	fault	4	voltage enabled	5	quick stop	6	switch on disabled	7	warning
Bit	Description																		
0	ready to switch on																		
1	switched on																		
2	operation enabled																		
3	fault																		
4	voltage enabled																		
5	quick stop																		
6	switch on disabled																		
7	warning																		

	8 = manufacturer-specific 9 = remote 10 = target reached* 11 = internal limit active 12-13 = mode-specific 14-15 = manufacturer-specific
* Note	Bit 10 = Target reached in Profile Position mode. Bit 10 = Reserved in Cyclic Synchronous Position mode, per CiA standard.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

605Ah – Quick Stop Option Code**Object Description**

Index	605A
Description	This object indicates the action to be performed upon a Quick Stop Operation. Ramp down is the deceleration value of the operation mode in use. The following value definitions are valid: 0 = Disables the drive, 2 = Slows down with ramp (6085h) down, then disables the drive. 6 = Slows down with ramp(6085h) down and remain in Operation Enabled
Object Code	Variable

Data Type	Integer16
Category	Optional
VarCom	Not applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0,2,6
Units	Not applicable

605Bh – Shutdown Option Code**Object Description**

Index	605B
Description	Indicates the action to be performed upon a transition from Operation Enabled state to the Ready To Switch On state. Ramp down is the deceleration value of the operation mode in use. Possible values: 0 = Disables the drive, then switches off the drive power stage. 1 = Slows down with ramp down, then disables the drive. -1 = According to VarCom DISMODE
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	Not applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0xFFFF
Lower Limit	0xFFFF
Upper Limit	0x0001
Units	Not applicable

605Ch – Disable Operation Option Code

Object Description

Index	605C
Description	Indicates the action to be performed upon a transition from Operation Enabled state to the Switch On state. Ramp down is the deceleration value of the operation mode in use. Possible values: 0 = Disables the drive, then switches off the drive power stage. 1 = Slows down with ramp down, then disables the drive. -1 = According to VarCom DISMODE
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	Not applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0xFFFF
Lower Limit	0xFFFF
Upper Limit	0x0001
Units	Not applicable

605Dh – Halt Option Code

Object Description

Index	605D
Description	Indicates the action to be performed when the halt function is executed. Ramp down is the deceleration value of the operation mode in use. The following value definitions are valid: PP/CSP 1= Slow down on ramp down and remain in Operation Enabled

	2,3 = Slow down on quick stop ramp and remain in Operation Enabled PV/CSV 1= Slow down on ramp down and remain in Operation Enabled 2,3 = Slow down on quick stop ramp and remain in Operation Enabled PT/CST 1,2 = Slow down due to 6087h(Torque slope) and remain in Operation Enabled 3 = Slow down due to 0 Torque and remain in Operation Enabled
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	Not applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 3
Units	Not applicable

605Eh – Fault Response Options**Object Description**

Index	605E
Description	Indicates the action to be performed when a fault (excluding communication faults) causes the drive to switch to Fault Reaction Active. Ramp down is the deceleration value of the operation mode in use. Possible values: 0 = Disable drive, motor is free to rotate

	1 = Slow down on ramp down -1 = According to VarCom DISMODE
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	Not applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0xFFFF
Lower Limit	0xFFFF
Upper Limit	0x0001
Units	Not applicable

6060h – Modes of Operation**Object Description**

Index	6060
Description	The requested operational mode. The following values are valid: 0 = no mode change / no mode assigned 1 = profile position mode 3 = profile velocity mode 4 = profile torque mode 5 = reserved 6 = homing mode 8 = cyclic synchronous position mode 9 = cyclic synchronous velocity mode 10 = cyclic synchronous torque
* Note	
Object Code	Variable
Data Type	Integer8
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	Values listed in Description, above
Units	Not Applicable

6061h – Modes of Operation Display**Object Description**

Index	6061
Description	Indicates the actual operation mode. The following values are valid: 0 = no mode change / no mode assigned 1 = profile Position mode 2 = velocity mode 3 = profile velocity mode 4 = profile torque mode 5 = reserved 6 = homing mode 8 = cyclic synchronous position mode 9 = cyclic synchronous velocity mode 10 = cyclic synchronous torque mode
Object Code	Variable
Data Type	Integer8
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	Values listed in Description, above
Units	Not Applicable

6062h – Position Demand Value**Object Description**

Index	6062
Description	Indicates the demanded position value
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

6063h – Position Actual Internal Value**Object Description**

Index	6063
Description	The actual value of the position measurement device.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

6064h – Position Actual Value**Object Description**

Index	6064
Description	Indicates the actual value of the position measurement device.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	PFB

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

6065h – Following Error Window**Object Description**

Index	6065
Description	<p>Maximum allowed position error without producing a fault. This object defines the range of tolerated position values symmetrical to the target position. If the position actual value is outside the following error window, a following error occurs. A following error may occur when a drive is blocked, an unreachable profile velocity occurs, or if closed-loop coefficients are wrong.</p> <p>If the value of the following error window is 4294967295, the following control is disabled.</p>
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	PEMAX (Maximum Position Error)

Entry Description

Access	Read/Write
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PDO Mapping	RxPDO
Default Value	1
Range	0 to 4294967295
Units	CAN user position units

6066h – Following Error Time Out

Object Description

Index	6066
Description	The time for a following error condition, after which bit 13 of the status word is set to 1 in the profile position mode and in the cyclic synchronous position mode. The reaction of the drive when a following error occurs is manufacturer-specific.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	millisecond (ms)

6067h – Position Window

Object Description

Index	6067
Description	The symmetrical range of accepted positions relative to the target position. If the actual value of the position encoder is within the position window, this target position is considered to be reached. If the value of the position window is 4294967295, the position window control is switched off.

Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	PEINPOS

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 4294967295
Units	CAN user position units

6068h –Position Window Time**Object Description**

Index	6068
Description	Indicates the time, during which the actual position within the position window is measured.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	PEINPOSTIME

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	5
Range	0 to 65535
Units	millisecond (ms)

606Bh –Velocity Demand Value**Object Description**

Index	606B
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Description	The output value of the trajectory generator.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	VCMD

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user velocity units

606Ch –Velocity Actual Value**Object Description**

Index	606C
Description	The actual velocity value derived either from the velocity sensor or the position sensor.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	V

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user velocity units

606Dh –Velocity Window**Object Description**

Index	606D
Description	The velocity window.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	CAN user velocity units

606Eh –Velocity Window Time**Object Description**

Index	606E
Description	The velocity window time.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	milliseconds (ms)

606Fh –Velocity Threshold**Object Description**

Index	606F
Description	The velocity threshold.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	CAN user velocity units

6070h – Velocity Threshold Time**Object Description**

Index	6070
Description	The velocity threshold time.
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 65535
Units	millisecond (ms)

6071h –Target Torque**Object Description**

Index	6071
Description	The input value for the torque controller in profile torque mode.
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	T (Current Command)

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	-32768 to 32767
Units	0.001 x MICONT (one-thousandth of rated torque)

6072h – Maxt Torque**Object Description**

Index	6072
Description	Max torque limit
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	Not applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	5000
Range	0 to 5000
Units	Not applicable

6073h –Maximum Current**Object Description**

Index	6073
Description	The configured maximum permissible torque creating current in the motor. Defined as MICONT (Motor Continuous Current)/1000 Thus, if MICONT = 10A: A value of 100 for 6073h = 1A A value of 500 for 6073h = 5A A value of 1000 for 6073h = 10A A value of 2000 for 6073h = 20A
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	ILIM

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 65535
Units	MICONT/1000

6074h – Torque Demand Value**Object Description**

Index	6074
Description	The output value of torque limit function.
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	ICMD

Entry Description

Access	Read Only
PDO Mapping	TxPDO

Default Value	0
Range	-32768 to 32767
Units	millinewton meter (mNm)

6075h – Motor Rated Current

Object Description

Index	6075
Description	The motor rated current. It is taken from the motor nameplate. Depending on the motor and drive technology this current is DC, peak or rms (root-mean-square) current. All relative current data refers to this value.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MICONT

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 4294967295
Units	mA

6076h – Motor Rated Torque

Object Description

Index	6076
Description	Indicates the motor rated torque. It is obtained from the motor nameplate. All related torque data must refer to this value. For linear motors, the object name is not changed, but the motor rated force value must be entered as multiples of mN.
Object Code	Variable
Data Type	Unsigned32
Category	Optional

VarCom	Not Applicable
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Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	0 to 4294967295
Units	mNm

6077h –Torque Actual Value**Object Description**

Index	6077
Description	This object provides the actual value of the torque. It corresponds to the torque in the motor.
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-32768 to 32767
Units	CAN user current units

6078h – Current Actual Value**Object Description**

Index	6078
Description	Indicates the actual value of the current. It corresponds to the current in the motor.
Object Code	Variable

Data Type	Integer16
Category	Optional
VarCom	I (Motor Current)

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-32768 to 32767
Units	CAN user current units

6079h – DC Link Circuit Voltage**Object Description**

Index	6079
Description	The bus voltage measured by sensors on the power module. Indicates the instantaneous DC link current voltage at the drive device.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	VBUSREADOUT (Bus Voltage Measured)

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 4294967295
Units	millivolt (mV)

607Ah –Target Position**Object Description**

Index	607A
Description	The commanded position the drive will move to in position profile

	mode or cyclic synchronous position mode. The value of this object can be interpreted as absolute or relative depending on bit 6 of the Controlword.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

607Ch – Home Offset**Object Description**

Index	607C
Description	<p>The configured difference between the zero position for the application and the machine home position (found during homing). During homing the machine home position is found and once the homing is completed the zero position is offset from the home position by adding the home offset to the home position. All subsequent absolute moves are taken relative to this new zero position.</p> <p>If this object is not implemented then the home offset is regarded as zero. The value of this object is in CAN position user units. Negative values indicate the opposite direction.</p>
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	HOMEOFFSET

Entry Description

Access	Read/Write
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PDO Mapping	No
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

607Dh –Software Position Limit

Object Description

Index	607D
Description	The configured maximal and minimal software position limits. These parameters define the absolute position limits for the position demand value and the position actual value. Every new target position is checked against these limits. The limit positions is always relative to the machine home position. Before being compared with the target position they are corrected internally by the home offset as follows: Corrected min position limit = min position limit – home offset Corrected max position limit = max position limit – home offset
Object Code	Array
Data Type	Integer32
Category	Optional
VarCom	Sub-index 1: POSLIMNEG Sub-index 2: POSLIMPOS

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Minimum software position limit
Object Code	Variable
Data Type	Integer32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

Sub-Index	002
Description	Maximum software position limit
Object Code	Variable
Data Type	Integer32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

607Eh –Polarity(not supported)

Object Description

Index	607E
Description	<p>Determines the sign of the position demand value or the velocity demand value.</p> <p>This object is organized bit-wise. The bits have the following meaning:</p> <p>7 = position polarity is affected</p> <p>6 = velocity polarity is affected</p> <p>The bit values have the following meaning:</p>

	0 = multiply the demand value by 1 1 = multiply the demand value by -1
Object Code	Variable
Data Type	Unsigned8
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 192
Units	Not Applicable

607Fh – Maximum Profile Velocity**Object Description**

Index	607F
Description	The maximum velocity allowed in either direction during a profiled motion.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	VLIM (User Velocity Limit)

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	CAN user velocity units

6080h –Motor Maximum Speed**Object Description**

Index	6080
Description	The maximum speed allowed for the motor in either direction. It is used to protect the motor and is taken from the motor data sheet.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	MSPEED

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	0
Range	0 to 4294967295
Units	rpm

6081h –Profile Velocity**Object Description**

Index	6081
Description	The configured velocity normally attained at the end of the acceleration ramp during a profiled motion. It is valid for both directions of motion. This object is used in the profile position mode and interpolated position mode.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 4294967295

Units	CAN user velocity units
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6083h –Profile Acceleration

Object Description

Index	6083
Description	The configured acceleration.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	ACC

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	1000
Range	1 to 4294967295
Units	CAN user acceleration/deceleration units

6084h –Profile Deceleration

Object Description

Index	6084
Description	The configured deceleration value. This object is used in the profile position mode, profile velocity mode, and interpolated position mode.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	DEC

Entry Description

Access	Read/Write
PDO Mapping	RxPDO

Default Value	1000
Range	1 to 4294967295
Units	CAN user acceleration/deceleration units

6085h – Quick Stop Deceleration

Object Description

Index	6085
Description	<p>The deceleration rate for an Active Disable/emergency stop.</p> <p>The configured deceleration used to stop the motor when the quick stop function is activated.</p> <p>This object indicates the deceleration used to stop the motor when the quick stop function is activated and the quick stop option code is set to 2 or 6.</p> <p>The quick stop deceleration is also used if the fault reaction option code is 2 and the halt option code is 2.</p>
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	DECSTOP

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	CAN user acceleration/deceleration units

6087h – Torque Slope

Object Description

Index	6087
Description	<p>The rate of change of torque.</p> <p>0:when the setting value is 0, no slope</p>
Object Code	Variable

Data Type	Unsigned32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 30000000
Units	mNm/s

608Fh – Position Encoder Resolution**Object Description**

Index	608F
Description	<p>The resolution of the motor encoder in number of lines per revolution of the motor.</p> <p>The position encoder resolution is calculated by the following: position encoder resolution = encoder increments ÷ motor revolutions</p> <p>The drive must be configured whenever this object is modified.</p>
Object Code	Array
Data Type	Unsigned32
Category	Optional
VarCom	Not Applicable

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No

Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Encoder increments
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2048
Range	16 to 10000000
Units	Lines per Revolutions

Sub-Index	002
Description	Motor revolutions
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	1
Range	1
Units	Not Applicable

6091h – Gear Ratio

Object Description

Index	6091
Description	The configured number of motor shaft revolutions and number of driving shaft revolutions.

	The gear ratio is calculated by the following: gear ratio = motor shaft revolutions ÷ driving shaft revolutions
Object Code	Array
Data Type	Unsigned32
Category	Optional
VarCom	Sub-index 1: FBGMS Sub-index 2: FBGDS

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable
Sub-Index	001
Description	Motor revolutions
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	Not Applicable
Sub-Index	002

Description	Shaft revolutions
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	Not Applicable

6092h – Feed Constant

Object Description

Index	6092
Description	The configured feed constant, which is the measurement distance per one revolution of the output shaft of the gearbox. The feed constant is calculated by the following: $\text{feed constant} = \text{feed} \div \text{driving shaft revolutions}$
Object Code	Array
Data Type	Unsigned32
Category	Optional
VarCom	Sub-index 1: PNUM Sub-index 2: PDEN

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2

Range	2
Units	Not Applicable
Sub-Index	001
Description	Feed. (The unit conversion numerator and fieldbus CANopen feed constant feed scaling factor.)
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	Not Applicable
Sub-Index	002
Description	Shaft revolutions. (The unit conversion denominator and fieldbus CANopen feed constant driving shaft scaling factor.)
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	Not Applicable

6098h – Homing Mode

Object Description

Index	6098
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Description	The homing method to be used. The following value definition is valid: 0 = no homing method assigned . . 1 = homing method 1 to be used 35 = homing method 36 to be used -x = manufacturer-specific Refer to the CiA-402 standard for the detailed description of each homing method.
Object Code	Variable
Data Type	Integer8
Category	Optional
VarCom	HOMETYPE

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	-192 to 35
Units	Not Applicable

6099h –Homing Speeds**Object Description**

Index	6099
Description	The commanded speeds used during homing procedure.
Object Code	Array
Data Type	Unsigned32
Category	Optional
VarCom	Sub-index 1: HOMESPEED1 Sub-index 2: HOMESPEED2

Entry Description

Sub-Index	000
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Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Homing speeds Speed for switch search
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	CAN user velocity units

Sub-Index	002
Description	Homing speeds Speed for zero search
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	CAN user velocity units

609Ah – Homing Acceleration

Object Description

Index	609A
Description	The acceleration and deceleration to be used during homing operation.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	HOMEACC

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	1
Range	1 to 4294967295
Units	CAN user acceleration/deceleration units

60B0h –Position Offset

Object Description

Index	60B0
Description	<p>The offset of the target position.</p> <p>The value itself is absolute and thus independent of how often it is transmitted over the communication system; for example, transmitting twice does not double the value. Since the additive position value represents an offset to the target position, it can be also used to control the drive with relative values in regard to the target position.</p> <p>This object is used in the cyclic synchronous position mode.</p>
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry Description

Access	Read/Write
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PDO Mapping	RxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

60B1h – Velocity Offset

Object Description

Index	60B1
Description	<p>Velocity offset value. Takes a commanded velocity value from the host controller and adds it to the velocity command entering the velocity loop.</p> <p>In Cyclic Synchronous Position mode this object contains the input value for velocity feed forward.</p> <p>In Cyclic Synchronous Velocity mode it contains the commanded offset of the drive device.</p> <p>The value itself is absolute and thus independent of how often it is transmitted over the communication system; that is, twice transmitted does not mean double value. Since the additive velocity value represents an offset to the target velocity, it can be also used to control the drive with relative values in regard to the target velocity.</p>
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	EXTADDITIVEVCMD

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user velocity units

60B2h – Torque Offset

Object Description

Index	60B2
Description	<p>Torque offset value. Takes a commanded current value from the host controller and adds it to the current command entering the current loop.</p> <p>In Cyclic Synchronous Position mode and Cyclic Synchronous Velocity mode, this object contains the input value for torque feed forward.</p> <p>In Cyclic Synchronous Torque mode, it contains the commanded additive torque of the drive, which is added to the target torque value.</p> <p>The value itself is absolute and thus independent of how often it is transmitted over the communication system; that is, twice transmitted does not mean double value.</p>
Object Code	Variable
Data Type	Integer16
Category	Optional
VarCom	EXTADDITIVEICMD

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	-32768 to 32767
Units	Not Applicable

60B8h – Touch Probe Function**Object Description**

Index	60B8
Description	<p>Indicates the configured function of the touch probe.</p> <p>This object is organized bit-wise. The bits have the following meaning:</p> <p>Bit Description</p> <p>0: 0 = switch off touch probe 1</p> <p>1 = enable touch probe 1</p> <p>1: 0 = trigger first event</p> <p>1 = continuous</p> <p>2: 0 = trigger touch probe 1 input</p>

	<p>1 = trigger with zero pulse signal or position encoder(not support)</p> <p>3: reserved</p> <p>4: 0 = switch off sampling at positive edge of touch probe 1 1 = enable sampling at positive edge of touch probe 1</p> <p>5: 0 = switch off sampling at negative edge of touch probe 1 1 = enable sampling at negative edge of touch probe 1</p> <p>6,7: user-defined (e.g. for testing)</p> <p>8: 0 = switch off touch probe 2 1 = enable touch probe 2</p> <p>9: 0 = trigger first event 1 = continuous</p> <p>10: 0 = trigger with touch probe 2 input 1 = trigger with zero pulse signal or position encoder(not support)</p> <p>11: reserved</p> <p>12: 0 = switch off sampling at positive edge of touch probe 2 1 = enable sampling at positive edge of touch probe 2</p> <p>13: 0 = switch off sampling on negative edge of touch probe 2 1 = enable sampling at negative edge of touch probe 2</p> <p>14,15: user-defined (e.g., for testing)</p>
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	PROBECONFIG

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 65535
Units	CAN user velocity units

60B9h –Touch Probe Status**Object Description**

Index	60B9
Description	<p>Indicates the status of the touch probe.</p> <p>This object is organized bit-wise. The bits have the following meaning:</p> <p>Bit Description</p> <p>0: 0 = touch probe 1 is switched off 1 = touch probe 1 is enabled</p> <p>1: 0 = touch probe 1 no positive edge value stored 1 = touch probe 1 positive edge position stored</p> <p>2: 0 = touch probe 1 no negative edge value stored 1 = touch probe 1 negative edge position stored</p> <p>3-5: reserved</p> <p>6,7: user-defined (e.g. for testing)</p> <p>Bit6: When TP1 Positive Edge Stored Toggle bit alternated</p> <p>Bit7: When TP1 Negative Edge Stored Toggle bit alternated</p> <p>8: 0 = touch probe 2 is switched off 1 = touch probe 2 is enabled</p> <p>9: 0 = touch probe 2 no positive edge value stored 1 = touch probe 2 positive edge position stored</p> <p>10: 0 = touch probe 2 no negative edge value stored 1 = touch probe 2 negative edge position stored</p> <p>11-13: reserved</p> <p>14,15: user-defined (e.g. for testing)</p> <p>Bit14: When TP2 Positive Edge Stored Toggle bit alternated</p> <p>Bit15: When TP2 Negative Edge Stored Toggle bit alternated</p>
Object Code	Variable
Data Type	Unsigned16
Category	Optional
VarCom	PROBESTATUS

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

60BAh –Touch Probe 1 Position Positive Value**Object Description**

Index	60BA
Description	The position value of touch probe 1 at the positive edge.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	user-defined position

60BBh –Touch Probe 1 Position Negative Value**Object Description**

Index	60BB
Description	The position value of touch probe 1 at the negative edge.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	user-defined position

60BCh – Touch Probe 2 Position Positive Value**Object Description**

Index	60BC
Description	The position value of touch probe 2 at the positive edge.
Note	Valid only for CANopen.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	user-defined position

60BDh –Touch Probe 2 Position Negative Value**Object Description**

Index	60BD
Description	The position value of touch probe 2 at the negative edge.
Note	Valid only for CANopen.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0

Range	-2147483648 to 2147483647
Units	user-defined position

60C2h –Interpolation Time Period

Object Description

Index	60C2
Description	<p>The configured interpolation cycle time.</p> <p>This object includes the following sub-indices:</p> <p>sub-index 1: value of the time</p> <p>sub-index 2: dimension index of the time value in sub-index 1</p> <p>The EtherCAT Master must set the interpolated time period, and must use the time period to send the SYNC message for clock synchronization.</p>
Note	<p>The cycle time of the controller must be equal to the cycle of the drive. This object is used to set the cycle time of the drive. Make sure this object is set to the same cycle time value as the controller.</p>
Object Code	Record
Data Type	Interpolation time period record (0080)
Category	Optional
VarCom	<p>Sub-index 1: FBITPRD</p> <p>Sub-index 2: FBITIDX</p>

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2

Range	2
Units	Not Applicable
Sub-Index	001
Description	Interpolation time period value
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read/Write
PDO Mapping	No
Default Value	4
Range	4 to 64
Units	250[microsecond]
Sub-Index	002
Description	Interpolation time index
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read only
PDO Mapping	No
Default Value	-4
Range	-4
Units	250[microsecond]

60C5h – Max Acceleration

Object Description

Index	60C5
Description	The maximum acceleration. It is used to limit the acceleration to an acceptable value in order to prevent the motor and the moved mechanics from being damaged.
Object Code	Variable

Data Type	Unsigned32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	4294967295
Range	1 to 4294967295
Units	CAN user acceleration/deceleration units

60C6h – Max Deceleration**Object Description**

Index	60C6
Description	The maximum deceleration. It is used to limit the deceleration to an acceptable value in order to prevent the motor and the moved mechanics from being damaged.
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	No
Default Value	4294967295
Range	1 to 4294967295
Units	CAN user acceleration/deceleration units

60D5h –Touch probe 1 positive edge counter**Object Description**

Index	60D5
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Description	Touch probe 1 positive edge counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

60D6h –Touch probe 1 negative edge counter**Object Description**

Index	60D6
Description	Touch probe 1 negative edge counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

60D7h – Touch Probe 2 Positive Edge Counter**Object Description**

Index	60D7
Description	Touch Probe 2 Positive Edge Counter
Object Code	Variable

Data Type	Unsigned16
Category	Optional

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

60D8h – Touch Probe 2 Negative Edge Counter**Object Description**

Index	60D8
Description	Touch Probe 2 Negative Edge Counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 65535
Units	Not Applicable

60F4h – Following Error Actual Value**Object Description**

Index	60F4
Description	The actual value of the following error.
Object Code	Variable
Data Type	Integer32
Category	Optional

VarCom	PE
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Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user position units

60FCh – Position Demand Internal Value**Object Description**

Index	60FC
Description	The output of the trajectory generator in profile position mode.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	0
Range	-2147483648 to 2147483647
Units	counts

60FDh – Digital Inputs**Object Description**

Index	60FD
Description	Indicates the state of the digital inputs.(when the input signals of the servo unit are vacant, can be configured as the remote IO of the host) The digital inputs object has 32 bits. bit 0 = digital input 1

	bit 1 = digital input 2 bit 4 = digital input 5 The bit values have the following meaning: 0 = switch is off 1 = switch is on
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	IN

Entry Description

Access	Read Only
PDO Mapping	TxPDO
Default Value	0
Range	0 to 4294967295
Units	Not Applicable

60FEh – Digital Outputs**Object Description**

Index	60FE
Description	Indicates the state of the digital outputs. Sub-index 1 of this object indicates the state of the digital outputs. This sub-index has 32 bits. bit 0 = digital output 1 bit 1 = digital output 2 bit 2 = digital output 3 ... The bit values have the following meaning: 0 = off 1 = on
Object Code	Unsigned32
Data Type	Array
Category	Optional
VarCom	OUT

Entry Description

Sub-Index	000
Description	Number of entries
Object Code	Variable
Data Type	Unsigned8
Category	Optional
Access	Read Only
PDO Mapping	No
Default Value	2
Range	2
Units	Not Applicable

Sub-Index	001
Description	Physical outputs For a master to write to the bit, the designated output function must be defined as idle mode (OUTMODE 0). The bit values for sub-index 1 have the following meaning: 0 = output is off 1 = output is on
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	0 to 4294967295
Units	Not Applicable

Sub-Index	002
Description	Output mask The bit values for sub-index 2 have the following meaning: 0 = output disabled; output will not change 1 = output enabled; output will change according to the

	controller command or defined functionality (OUTMODE)
Object Code	Variable
Data Type	Unsigned32
Category	Optional
Access	Read/Write
PDO Mapping	Yes
Default Value	0
Range	0 to 4294967295
Units	Not Applicable

60FFh – Target Velocity

Object Description

Index	60FF
Description	The configured target velocity and is used as input for the trajectory generator.
Object Code	Variable
Data Type	Integer32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read/Write
PDO Mapping	RxPDO
Default Value	0
Range	-2147483648 to 2147483647
Units	CAN user velocity units

6502h – Supported Drive Modes

Object Description

Index	6502
Description	This object is organized bit-wise. The bits have the following meaning: Bit Description

	<p>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</p> <p>The bit values have the following meaning: 0 = mode is not supported 1 = mode is supported</p>
Object Code	Variable
Data Type	Unsigned32
Category	Optional
VarCom	Not Applicable

Entry Description

Access	Read Only
PDO Mapping	No
Default Value	941
Range	941
Units	Not Applicable

10 EtherCAT Error Codes

10.1 Warning Codes

BDHDE drive warnings are reported in object 2011h.

Since BDHDE warnings are 96 bits, they have three 32-bit segments.

Table 10-1. Warning Codes and messages

Abort Code	Description	7-segment	WRN #
00000000 00000000 00000008h	Under-Voltage	u	WRN 4
00000000 00000000 00000010h	Power Stage Over-Temperature	t	WRN 5
00000000 00000000 00004000h	Hardware Positive Limit Switch is Open	L1	WRN 15
00000000 00000000 00008000h	Hardware Negative Limit Switch is Open	L2	WRN 16
00000000 00000000 00010000h	Hardware Positive and Negative Limit Switches are Open	L3	WRN 17
00000000 00000000 00020000h	Software Positive Limit Switch is Tripped	L4	WRN 18
00000000 00000000 00040000h	Software Negative Limit Switch is Tripped	L5	WRN 19
00000000 00000000 00080000h	Software Limit Switches are Tripped	L6	WRN 20
00000000 00000000 00200000h	Multi-turn Encoder Battery Low Voltage	b	WRN 22
00000000 00000000 80000000h	Bus AC Supply Line Disconnected	o	WRN 32
00000000 00000002 00000000h	Regen Resistor Overload	c	WRN 34
00000000 00000008 00000000h	Realtime Overload Warning	_	WRN 36
00000000 00000020 00000000h	Integrated Power Module Over-Temperature	t	WRN 38
00000000 00008000 00000000h	Default Drive Configuration	n/a	WRN 48
00000001 00000000 00000000h	Restore Factory Parameter Fail	n/a	WRN 65
00000002 00000000 00000000h	Read Parameter EEPROM Fail	Ee1	WRN 66
00000004 00000000 00000000h	Clear Fault History Fail	CF	WRN 67
00000008 00000000 00000000h	Parameter Out of Range When Read From Parameter EEPROM	Ee2	WRN 68
00000040 00000000 00000000h	Write Power Board EEPROM Fail	Ee3	WRN 71
00000080 00000000 00000000h	Write Control Board EEPROM Fail	Ee4	WRN 72
00000100 00000000 00000000h	HDM Warning	n/a	WRN 73

10.2 Error and Fault Codes

Service Request Error (Abort) Codes

An SDO operation may return one of the SDO abort codes specified in the CANopen standard, listed in Table 10-2.

If an SDO fails due to a manufacturer-specific error, the SDO abort code will be 08000000h.

The service request error (abort) codes that the drive sends to the master device when the master issues an invalid SDO request to the drive.

Table 10-2. CANopen Standard SDO Abort Codes

Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specifier not valid or unknown.
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write only object.
0601 0002h	Attempt to write a read only object.
0601 0003h	Entry cannot be written because Subindex0 is not 0.
0601 0004h	The object cannot be accessed via complete access.
0602 0000h	Object does not exist in the object dictionary.
0607 0010h	Data type does not match, length of service parameter does not match
0609 0011h	Sub-index does not exist.
0609 0030h	Invalid value for parameter (download only).
0609 0031h	Value of parameter written too high (download only).
0609 0032h	Value of parameter written too low (download only).
060A 0023h	Resource not available: SDO connection
0800 0000h	General error
0800 0020h	Data cannot be transferred or stored to the application.
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of a file error).

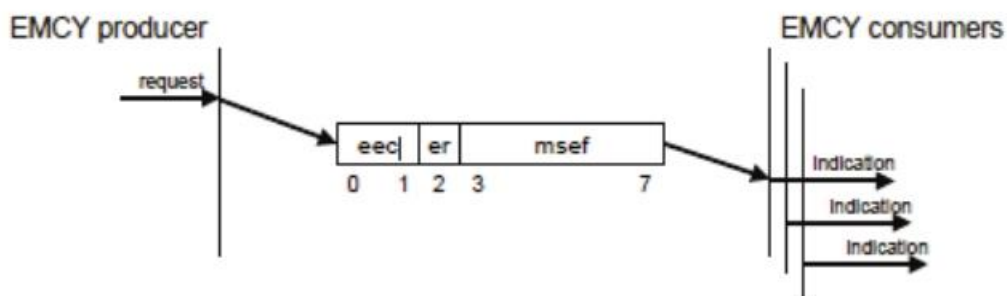
Emergency Error (Fault) Codes

Unlike the synchronous service request error (abort) codes which are always sent as response to a request, the emergency error (fault) codes are asynchronous. These events can occur at any time regardless of the user command (for example, temperature is too high).

Upon detection of internal device errors, the drive will transmit emergency message frames over the CANopen network using COB-ID EMCY. An emergency message frame will be transmitted only once per error event and consists of the error code and the actual state of the Error Register object.

Table 10-3. Emergency Message Frame

Byte	0	1	2	3	4	5	6	7
Description	Emergency error code		Error register	Manufacturer-specific				



When an illegal state occurs in the drive, the drive sends the code to the master device as object 603Fh (Error Code).

Whenever the value of 603Fh is not zero, there is a fault in the drive. The CANopen state machine enters Fault mode, and the drive cannot be enabled. If, for example, the Motor Foldback is occurred; the drive will send the code 2310h to the master device as object 603Fh (Error Code).

Table 10-4. Emergency Error Codes (Faults)

Fault Code	Fault Message/Description	7-segment	FLT #
0x2214	Hardware over-current	F24	FLT 146
0x2214	Over-Current	P	FLT 3
0x2250	IPM Bottom Leg Short Circuit	F20	FLT 166
0x2310	Motor Foldback	F2	FLT 17
0x2311	Drive Foldback	F1	FLT 16
0x2330	UVW to Ground Short Circuit	F21	FLT 167
0x2380	Current-Sensors Offset Invalid	e109	FLT 43
0x2380	Current Sensor boot strap error	F23	FLT 155
0x2382	Digital Output Over-Current Fault	o9	FLT 105
0x3110	Over-Voltage	o	FLT 9
0x3120	Under-Voltage	u	FLT 11
0x3183	Bus AC Supply Line Disconnect	o7	FLT 78
0x3199	Regeneration fault	F4	FLT 148

0x3199	Regen Resistor Overload	o8	FLT	83
0x4080	Integrated Power Module Over-Temperature	t2	FLT	39
0x4310	Power Stage Over-Temperature	t1	FLT	10
0x5530	Power EEPROM Fault	e107	FLT	7
0x5530	Failure Writing to Power EEPROM	F13	FLT	159
0x5581	Control EEPROM Fault	e106	FLT	6
0x5581	Parameter EEPROM Fault	F11	FLT	157
0x5581	Failure Writing to Control EEPROM	F14	FLT	160
0x5585	Parameter Memory Checksum Failure	e	FLT	2
0x5585	Eeprom version error	F0	FLT	154
0x5585	Control EEPROM Checksum Failure	F12	FLT	158
0x5585	Control Board and Power Board Mismatch	F15	FLT	161
0x5585	Power EEPROM Checksum Failure	F9	FLT	153
0x5586	Failure Writing to Flash Memory	E	FLT	12
0x6100	Homing Error	HE	FLT	174
0x6320	Power On Time Out	F10	FLT	156
0x6320	No Signal for Touch Probe	F16	FLT	162
0x6320	Electrical Gear Calculate Overflow	F17	FLT	163
0x6320	Electrical Gear Over Range	F18	FLT	164
0x6320	Regeneration resistance less than 40 Ohm	F25	FLT	147
0x6320	Drive parameter initialize fail	F7	FLT	151
0x6320	Motor parameter initialize fail	F8	FLT	152
0x6320	HDM 1	H1	FLT	169
0x6320	HDM 2	H2	FLT	170
0x6320	HDM 3	H3	FLT	171
0x6320	HDM4	H4	FLT	172
0x6320	HDM 5	H5	FLT	173
0x6381	Not Configured	-1	FLT	12
0x6581	FPGA Config Failed	e101	FLT	5
0x7090	FPGA Version Mismatch	e120	FLT	47
0x7091	Emergency Stop Issued	n3	FLT	57
0x7121	Stall Fault	F3	FLT	59
0x7305	Encoder Multi-turn Counter Overflow	F22	FLT	168
0x7380	Feedback Communication Error	r20	FLT	34
0x7382	SenseAR Init Failed	F19	FLT	165
0x7382	Tamagawa Init Failed	r24	FLT	42

0x7385	Absolute Multi-turn Encoder Battery Low Voltage Fault	r29	FLT	56
0x7388	Tamagawa Abs Operational Fault	r26	FLT	49
0x738D	SensAR Encoder Fault	r40	FLT	82
0x7580	Fieldbus Cable Disconnected	Fb3	FLT	65
0x818D	EtherCAT Packet Loss	Fb8	FLT	91
0x8481	Velocity Over-Speed Exceeded	J	FLT	14
0x8482	Exceeded Maximum Velocity Error	J2	FLT	67
0x8689	Excessive PE Value	J3	FLT	87
0xF080	CAN/EtherCAT State Not Operational	Fb9	FLT	92
0xFF02	Motor Plate Read Failed	e123	FLT	85
0xFF04	Realtime Overload Fault	-	FLT	89
0xFF14	MOTORNAME and MTP data are not compatible	e131	FLT	108

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