HT7

EtherCAT®

Stepper Motor Drive

EtherCAT User Manual

Manual r06

Company Quality Assurance conforming

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1 Introduction

1.1 Warnings

This document is meant for qualified technical personnel. You must read carefully and understand the manual, then follow the instruction given here before starting any activities.

1.2 General Info

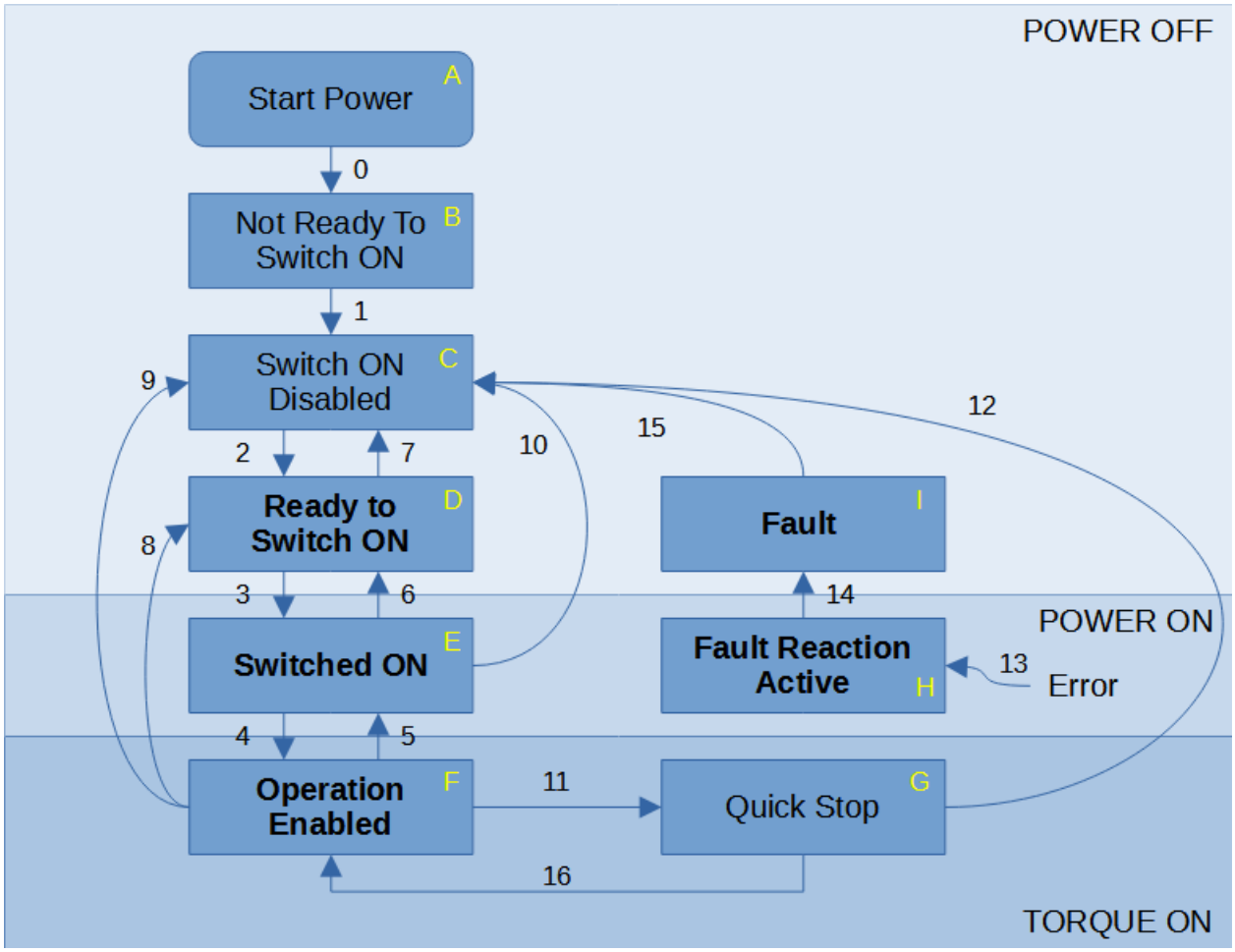
This document provides the necessary information to use the HT7 stepper motor drive by mean of EtherCAT communication. It contains descriptions of the architecture, device states, operation modes, error handling and object dictionary. Wiring schemes and electrical characteristics can be found on the HT7_HW_MANUAL, available on our website: www.shsitalia.it

1.3 Configuration File

Refere to ESI configuration file “HT7_ECAT_3_05_DC.xml”.

2 Device Control

The state machine describes the drive states and the possible transition among them. Each state determines a drive behavior and the accepted control commands. The drive state can be read by means of the **Statusword**, while the transitions can be automatic or acted by the **Controlword**.



Not ready to Switch On state is performed automatically by the driver during startup.

Bold states are stable states and shall be checked by the control device.

Transitions 3 and 4 can only be requested by the control device.

Switch On Disabled can be passed through automatically, the control device has to perform transition 2 only if needed.

2.1 Drive State

The current state of the driver can be read by the following bits of the *Statusword*.

State	Statusword (binary)	Description
Start	xxxx xx0x x000 0000	Bootup
Not ready to Switch On	xxxx xx1x x000 0000	Drive is disabled
Switch On Disabled	xxxx xx1x x100 0000	Drive initialization completed Drive disabled Parameter can be changed
Ready to Switch On	xxxx xx1x x010 0001	Drive disabled Parameter can be changed
Switched On	xxxx xx1x x010 0011	Drive disabled
Operation Enabled	xxxx xx1x x011 0111	Drive enabled Motor is powered No faults
Quickstop Active	xxxx xx1x x001 0111	Quickstop is being executed Drive enabled Motor is powered
Fault reaction active (when disabled)	xxxx xx1x x000 1111	A fault occurred Drive disabled
Fault reaction active (when enabled)	xxxx xx1x x001 1111	A fault occurred Drive enabled The fault reaction is being executed
Fault	xxxx xx1x x000 1000	A fault occurred Drive disabled Parameter can be changed

Table 2-1 Device State Bits on Statusword

2.2 Device Control Commands

A state transition can be caused by an internal event or by a command sent via the *Controlword*. To trigger these events, the *Controlword* bits shall be set as per the following Table 2-2.

Command	Controlword (binary)	State transitions
Shutdown	xxxx xxxx 0xxx x110	2, 6, 8
Switch On	xxxx xxxx 0xxx x111	3
Enable operation	xxxx xxxx 0xxx 1111	4, 16
Disable voltage	xxxx xxxx 0xxx xx0x	7, 9, 10, 12
Quickstop	xxxx xxxx 0xxx x01x	7, 10, 11
Disable operation	xxxx xxxx 0xxx 0111	5
Fault reset	xxxx xxxx 1xxx xxxx	15

Table 2-2 Device Control Commands

3 Errors

3.1 Device Errors

When the drive detects an error, it generates an error code. The reaction to an error depends on error type and option code. After execution of the fault reaction, the device changes to fault state and the drive will be disabled.

The Error Register 0x1001 describes the error happened on the device, a more detailed description of the error can be read on Error Code Object 0x603F.

3.2 Communication Errors

An abort object will be sent over the network instead of a response to an SDO request if the request was not successful. Table 3-1 describes the possible abort codes and their causes.

Abort Code	Name
0x 0503 0000	Toggle bit has not changed
0x 0504 0000	SDO protocol timeout
0x 0504 0001	Invalid command received
0x 0504 0005	Out of memory
0x 0601 0000	Access to the object not supported
0x 0601 0001	Attempt to read to a write only object
0x 0601 0002	Attempt to write to a read only object
0x 0602 0000	Object not listed in the object directory
0x 0604 0041	Object cannot be mapped to PDO
0x 0604 0042	Number or length of the objects to be mapped exceeds the PDO length
0x 0604 0043	General parameter incompatibility
0x 0604 0047	General internal parameter incompatibility
0x 0606 0000	Access denied due to a hardware error
0x 0607 0010	Wrong data type or length of the service parameter does not match
0x 0607 0012	Wrong data type or length of the service parameter is too large
0x 0607 0013	Wrong data type or length of the service parameter is too small
0x 0609 0011	Subindex does not exist
0x 0609 0030	Invalid value of the parameter (write access only)
0x 0609 0031	Value of the parameter is too large
0x 0609 0032	Value of the parameter is too small
0x 0609 0036	Maximum value is less than minimum value
0x 0800 0000	General error
0x 0800 0020	Data cannot be transferred or saved in the application
0x 0800 0021	Data cannot be transferred or saved in the application due to local control

Abort Code	Name
0x 0800 0022	Data cannot be transferred or saved in the application due to device state
0x 0800 0023	Dynamic generating of the object directory failed or no object directory available

Table 3-1 Abort Codes Description

4 System Units

The drive uses fixed internal drive units to manage the movements, nevertheless user can act on some parameters in order to have convenient physical units, as explained on this section.

Internal units are described on Table 4-1 below.

Internal Units	Definition
Position	Steps
Speed	Steps/s
Acceleration	ms/10,000steps

Table 4-1 Internal Units Definition

Physical units are described on Table 4-2 below.

Internal Units	Definition
Position	1 turn
Speed	rpm
Acceleration	rpm/s

Table 4-2 Physical Units Definition

User can act on the Gear Ratio Object 0x6091 and Feed Constant Object 0x6092 to obtain the motion values on suitable units for its mechanical system.

5 Operating Modes

5.1 Overview

The drive behavior depends on the activated mode of operation. The mode can be chosen writing the *Modes of Operation* object, while the drive provides the *Modes of operation display* to identify the active operation mode.

PDOs, *Statusword*, *Controlword* and set-points are mode-specific, so the control device shall manage the various operation modes correctly.

HT7 drive supports the modes of operation on Table 5-1 and will be explained later:

Mode of operation	Abbreviation	Code
Profile position mode	pp	1

Mode of operation	Abbreviation	Code
Profile velocity mode	pv	3
Homing mode	hm	6

Table 5-1 Supported operation modes

The supported modes are listed in the object *Supported drive modes*.

5.2 Profile position mode (pp)

5.2.1 Overview

When the drive is in pp mode, the position control loop is closed on the drive side. The control device can manage the positioning by acting on the objects shown in Figure 5-1 below.

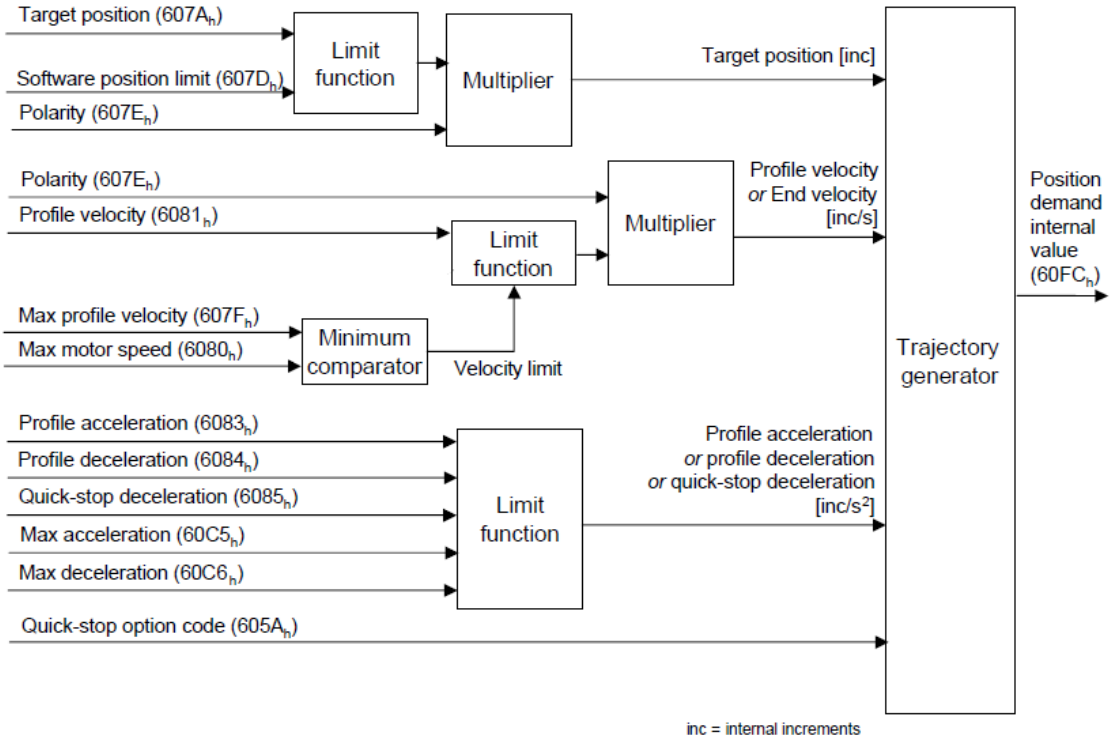


Figure 5-1 Trajectory generator for pp mode

Set-points handshake is controlled by the *Controlword* bits *new set-point*, as well as the bit *set-point acknowledgement* in the *Statusword*.

After a set-point is applied to the drive, the control device signals that the set-point is valid by a rising edge of the *new set-point* bit. The drive device sets the *set-point acknowledgement* bit and, afterwards, the drive signals its ability to receive a new set-point clearing the *set-point acknowledgement* bit. An example is shown in Figure 5-2.

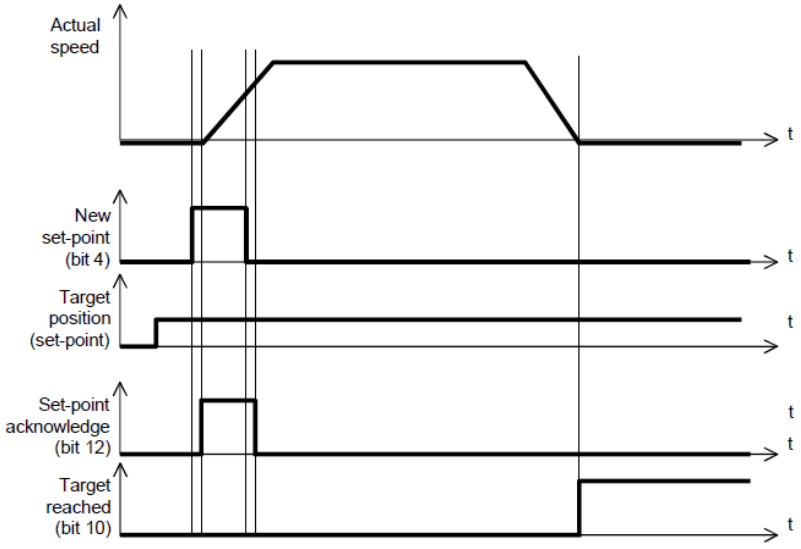


Figure 5-2 Set-point example

5.2.2 Controlword Profile Position mode-specific bits

The profile position mode uses some bits of the *Controlword* for mode-specific purposes, as highlighted on Table 5-2 explain the usage of these bits.

Bit	Value	Definition
4	0 → 1	New Setpoint, start move
6	0	Target position is an absolute value
	1	Target position is a relative value
8	0	Positioning shall be executed or continued
	1	Motor shall be stopped accordingly to halt option code object (0x605D)

Table 5-2 Controlword bits 4, 6 8 in pp mode

5.2.3 Statusword Profile Position mode-specific bits

The profile position mode uses some bits of the *Statusword* for mode-specific purposes, Table 5-4 explain the meaning of these bits.

Bit	Value	Definition
10	0	Target position not reached
	1	Target position reached
12	0	Previous setpoint already processed
	1	Previous setpoint still in process, setpoint can be overwritten
13	0	No following error
	1	Following error

Table 5-4 Statusword bits 10, 12, 13 in pp mode

5.3 Profile velocity mode (pv)

5.3.1 Overview

When the drive is in pv mode, the position control loop is closed on the drive side. The control device can manage the positioning by acting on the objects shown in Figure 5-5 below.

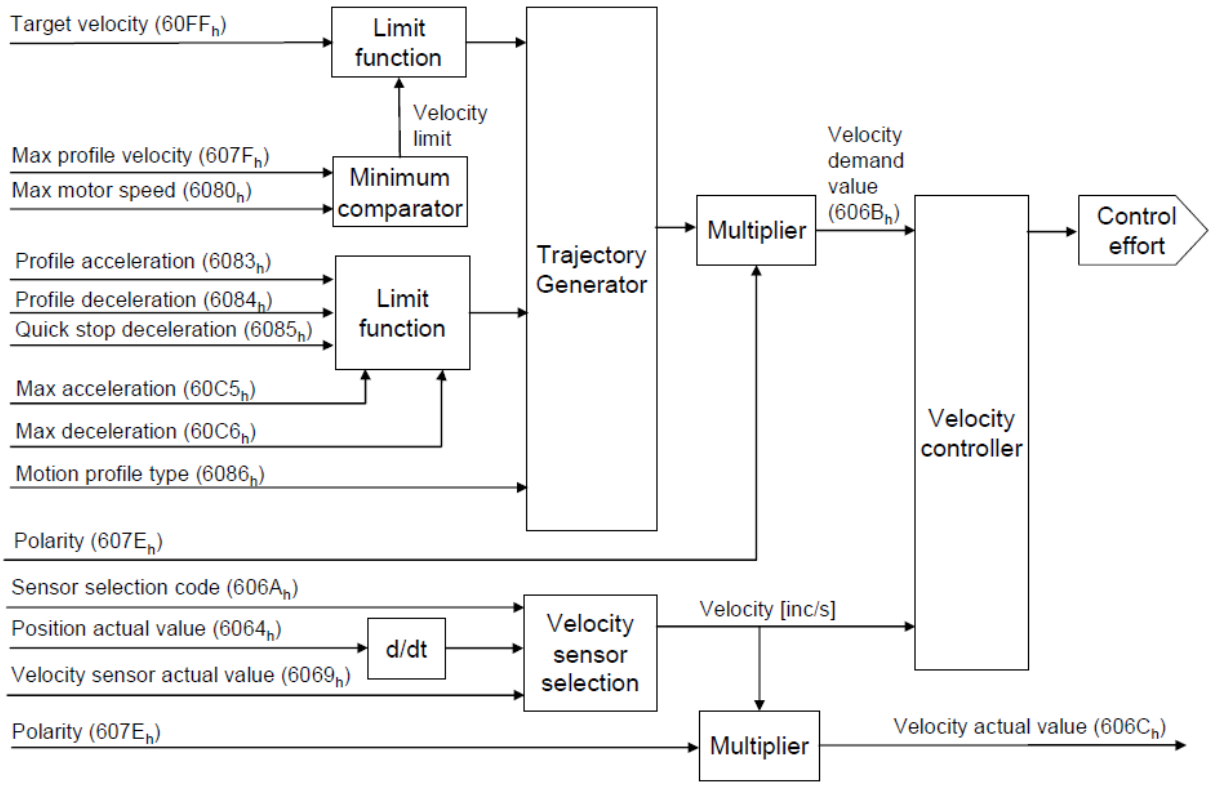


Figure 5-5 Profile velocity mode

The profile velocity mode doesn't have handshake mechanism (contrary to the profile position mode), every time a parameter is changed, the new value is updated immediately.

5.3.2 Controlword Profile Velocity mode-specific bits

The profile velocity mode uses *Halt* bit 8 of the *Controlword* for mode-specific purposes, as highlighted on Table 5-5.

Bit	Bit 5	Definition
8	0	The motion shall be executed or continued
	1	Motor shall be stopped accordingly to halt option code object (0x605D)

Table 5-5 Controlword bit 8 in pv mode

5.3.3 Statusword Profile Velocity mode-specific bits

The profile position mode uses some bits of the *Statusword* for mode-specific purposes, Table 5-6 explain the meaning of these bits.

Bit	Value	Definition
10	0	Target velocity not reached
	1	Target velocity reached
12	0	Speed is not equal to 0
	1	Speed is equal to 0
13	0	Not used
	1	Not used

Table 5-6 Statusword bits 10, 12, 13 in pv mode

5.4 Homing mode (hm)

5.4.1 Overview

This operation mode is used to make the drive seek for the zero (homing) position. Figure 5-8 shows the objects involved in this functionality. The home position and the zero position are offset by the home offset. Actually, HT7 drive supports the methods described in the following sections and available on the object *Supported homing methods*.

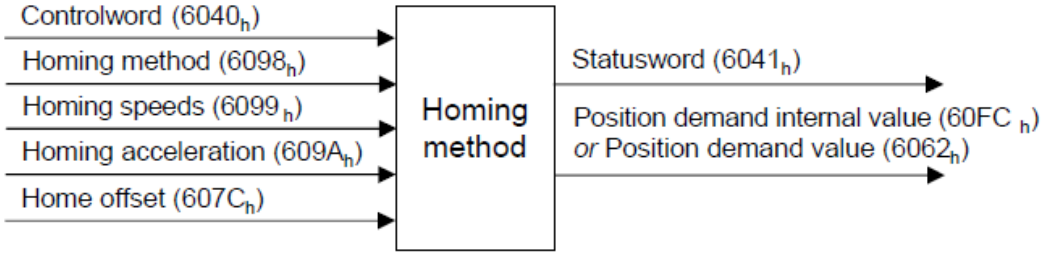


Figure 5-8 Homing mode function

To select the drive input to have homing, use the object Digital Inputs Configuration (0x2070) and Digital Inputs Functionalities(0x2071).

5.4.2 Controlword Homing mode mode-specific bits

To start the homing position, the *Homing operation start*, bit 4 in the *Controlword*, must be set. The motor can be halted during the homing procedure setting the *Halt* bit in *Controlword*.

5.4.3 Statusword Homing mode mode-specific bits

The bits of the Statusword listed in Table 5-7 describes the operative status of the drive when in homing mode.

Bit 13	Bit 12	Bit 10	Definition
0	0	0	Homing procedure in progress
0	0	1	Homing procedure interrupted or not started
0	1	0	Homing is attained, but target is not reached
0	1	1	Homing procedure completed successfully
1	0	0	Homing error occurred, velocity is not 0
1	0	1	Homing error occurred, velocity is 0
1	1	X	Reserved

Table 5-7 Statusword bits 10, 12, 13 in homing mode

5.4.4 Homing Method 1 (Negative Limit Switch with Encoder Index)

After the *Homing operation start* bit has been set, the drive starts the motor in CCW direction (toward the negative position), until the negative limit switch is reached, then it moves in positive direction to disengage the switch. After the switch has been disengaged, the motor start again in positive direction until the encoder index has been reached. When motor is still, the *Position Actual Value* will be set to *Home Offset* value.

5.4.5 Homing Method 17 (Negative Limit Switch)

After the *Homing operation start* bit has been set, the drive starts the motor in CCW direction (toward the negative position), until the negative limit switch is reached, then it moves in positive direction to disengage the switch. After the switch has been disengaged, the *Position Actual Value* will be set to *Home Offset* value.

5.4.6 Homing Method 37 (Homing on current position)

When the *Homing operation start* bit is set, the actual position is set as the home position. This function does not require the drive to be in operational enabled state. After the homing process the *Position Actual Value* will be equal to *Home Offset*.

6 Encoder Feedback

A digital encoder sensor can be connected to the drive, both single ended and differential sensors are accepted; wiring instructions are available into the hardware manual.

The behavior of the drive when the encoder is used is configured by the Encoder Mode sub-index of the Encoder Configuration Object 0x2032. The available modes are described in the next chapters.

6.1 Encoder Mode 0

When the Encoder Mode sub-index is set to 0, the encoder doesn't affect the positioning, the position can be read on Encoder Counts Object 0x2030.

6.2 Encoder Mode 1

If this mode is active, the drive checks whether the difference between the theorical position and the encoder feedback position is lower than the value set in Encoder Fault Steps Object 0x2034.

When this condition is violated, the drive rise an error in the statusword, based on the active operating mode, see Table 6-1. The motor keeps running until the target position is reached.User must take into account that if the stepper motor is in a stall condition, it should be stopped and restarted in order to exit this condition.

Active Mode	Statusword flag	Encoder Error action	Statusword bit
Profile Position	Following Error	Rise	13
Profile Velocity	Speed	Rise	13

Table 6-1 Encoder action on statusword

6.3 Encoder Mode 2

If this mode is active, the drive checks whether the difference between the theorical position and the encoder feedback position is lower than the value set in Encoder Fault Steps Object 0x2034.

When this condition is violated, an error in the statusword, based on the active operating mode, see Table 6-1. Despite mode 1, the drive stops the motor.

7 Inputs and Outputs

7.1 Digital inputs

Digital inputs can be mapped to predefined functions or as general-purpose inputs, by mean of the Digital Inputs Configuration Object 0x2070. By modifying the Digital Inputs Functionalities Object 0x2071, the polarity can be set-up for all the functions, while only the general-purpose inputs can be masked. Figure 7-1 shows this behavior.

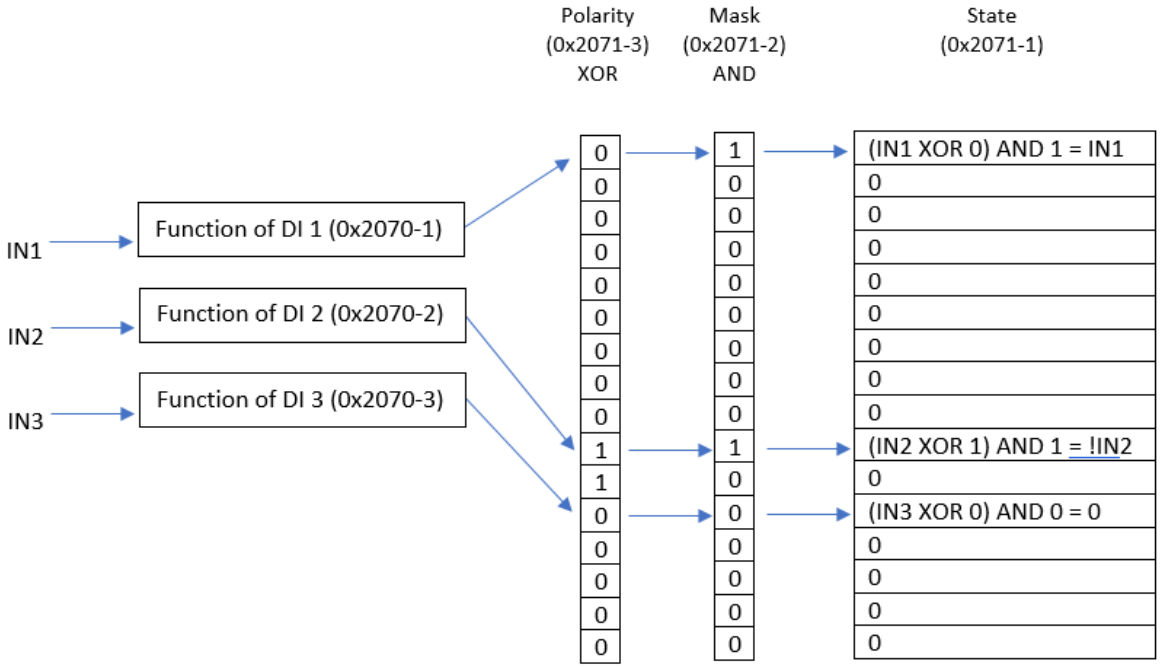


Figure 7-1 Digital Inputs usage

7.2 Digital outputs

Digital outputs (OUT1, OUT2 and OUT3) can be mapped as general-purpose outputs, by mean of the Digital Outputs Configuration Object 0x2078. The value and the mask can be set modifying the Digital Outputs Functionalities Object 0x2079.

7.3 Analog input

Analog inputs can’t be read or assigned to a function by the control device.

7.4 Analog output

Analog outputs can’t be write or assigned to a function by the control device.

8 EtherCAT communication

8.1 EtherCAT State Machine

The EtherCAT State Machine in Figure 8-1 indicates which functionalities are actually available. The functions in the different states are described in Table 8-1below. Transitions among states are described in Table 8-2.

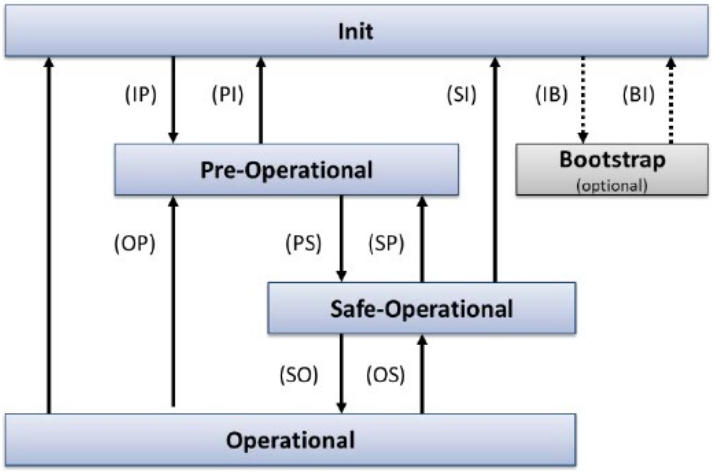


Figure 8-1 EtherCAT Slave State Machine

State	Description
INIT Init state	No communication on the application layer is available. The master has access only to the DL-information registers
PREOP Pre-Operational state	Mailbox communication on the application layer available, but no process data communication available. Master setup cyclic communication via PDOs
SAFEOP Safe-Operational state	Mailbox communication on the application layer, process (input) data communication available. In SafeOp only inputs are evaluated; outputs are kept in 'safe' state.
OP Operational state	Process data inputs and outputs are valid.
BOOT Bootstrap state	No process data communication. Communication only via mailbox on Application Layer available. Used for firmware updates.

Table 8-1 EtherCAT State Machine Description

Transition	Description
I -> P	Master reads VendorID, ProductCode and RevisionNumber from EEPROM, and configures DL registers, SyncManager registers for mailbox communication and initialize DC clock synchronization. Master requests PreOp state and waits for status confirmation.

Transition	Description
P -> S	Start of cyclic communication. Master configures parameters using mailbox communication. Master requests SafeOp state and waits for confirmation.
S -> O	Master sends valid Outputs and requests Op state
Error Init Error PreOp Error SafeOp	Incorrect ESC register configuration (DC, FMMU, SyncManager, etc.). The AL Status Code register (register 0x134) indicates error reasons.

Table 8-2 EtherCAT State Machine Transitions

9 Object Dictionary

9.1 Overview

9.1.1 Object Dictionary Overview

Index	Name	Data type	Access
0x1000	Device Type	UINT32	RO
0x1001	Error Register	UINT8	RO
0x1008	Manufacturer Device Name	STRING	RO
0x1009	Hardware Version	STRING	RO
0x100A	Software Version	STRING	RO
0x1018	Identity Object	RECORD	RO
0x10F1	Error Setting	RECORD	RW
0x1600	Receive PDO 1 Mapping	RECORD	RW
0x1700	Receive PDO 256 Mapping	RECORD	RO
0x1A00	Transmit PDO 1 Mapping	RECORD	RW
0x1B00	Transmit PDO 256 Mapping	RECORD	RO
0x1C00	Sync Manager Communication Type	RECORD	RO
0x1C12	SM2 assignment	RECORD	RO
0x1C13	SM3 assignment	RECORD	RO
0x1C32	Sync Manager 2 Parameter	RECORD	RW/RO
0x1CC3	Sync Manager 3 Parameter	RECORD	RW/RO
0x2010	Phase Current	UINT16	RW
0x2011	Phase Current Reduction	UINT8	RW
0x2012	Phase Current Reduction Time	UINT8	RW
0x2013	Low Noise Mode	UINT8	RW
0x2018	Min frequency	UINT16	RW
0x2020	Drive Temperature	UINT16	RO
0x2030	Encoder Count	INT32	RO
0x2032	Encoder Configuration	RECORD	RW
0x2034	Encoder Fault Steps	UINT16	RW
0x2070	Digital Inputs Configuration	RECORD	RW
0x2071	Digital Inputs Functionalities	RECORD	RW/RO
0x2078	Digital Outputs Configuration	RECORD	RW
0x2079	Digital Outputs Functionalities	RECORD	RW
0x603F	Error Code	UINT16	RO
0x6040	ContolWord	UINT16	RW
0x6041	Statusword	UINT16	RO
0x605A	Quick stop option code	INT16	RW
0x605B	Shutdown option code	INT16	RW
0x605C	Disable operation option code	INT16	RW
0x6060	Modes of operation	INT8	RW

Index	Name	Data type	Access
0x6061	Modes of operation display	INT8	RO
0x6062	Position Demand Value	INT32	RO
0x6063	Position actual internal value	INT32	RO
0x6064	Position actual value	INT32	RO
0x606B	Velocity Demand Value	INT32	RO
0x606C	Velocity Actual Value	INT32	RO
0x606D	Velocity window	UINT16	RW
0x606E	Velocity window time	UINT16	RW
0x6079	DC link circuit voltage	INT32	RO
0x607A	Target position	INT32	RW
0x607C	Home offset	INT32	RW
0x607D	Software position limit	RECORD	RW
0x607E	Polarity	UINT8	RW
0x607F	Max profile velocity	UINT32	RW
0x6081	Profile velocity	UINT32	RW
0x6083	Profile acceleration	UINT32	RW
0x6085	Quick stop deceleration	UINT32	RW
0x6091	Gear ratio	RECORD	RW
0x6092	Feed constant	RECORD	RW
0x6098	Homing method	INT8	RW
0x6099	Homing speeds	RECORD	RW
0x609A	Homing acceleration	UINT32	RW
0x60B8	Touch Probe Function	UINT16	RW
0x60B9	Touch Probe Status	UINT16	RO
0x60BA	Touch Probe Position 1 positive value	INT32	RO
0x60BB	Touch Probe Position 1 negative value	INT32	RO
0x60D0	Touch Probe Source	RECORD	RW
0x60D5	Touch Probe 1 positive edege counter	UINT16	RO
0x60D6	Touch Probe 1 negative edege counter	UINT16	RO
0x60E3	Supported homing methods	RECORD	RO
0x60EF	Motor resolution	UINT32	RW
0x60FC	Position demand internal value	INT32	RO
0x60FF	Target velocity	INT32	RW
0x6502	Supported drive modes	UINT32	RO
0xF000	Modular Device Profile	RECORD	RO
0xF010	Module Profile List	RECORD	RO
0xF050	Detected Module List	RECORD	RO

Table 9-1 Object Dictionary Table

9.1.2 Object Data Types

Type	Description	Size [bits]	Range
BOOLEAN	Boolean value	8	0 - 1
INTEGER8	Signed integer	8	-128 … 127

Type	Description	Size [bits]	Range
INTEGER16	Signed integer	16	-32768 … 32767
INTEGER32	Signed integer	32	-2147483648 … 2147483647
UNSIGNED8	Unsigned integer	8	0 … 255
UNSIGNED16	Unsigned integer	16	0 … 65535
UNSIGNED32	Unsigned integer	32	0 … 4294967265
UNSIGNED64	Unsigned integer	64	0 … 18446744073709551615
VISIBLE_STRING	Array of n char	n * 8	-
RECORD	Structure of types	variable	-

Table 9-2 Object Data Types

9.1.3 Object Access Types

Attribute	Description
RW	Read and Write access
RO	Read only access
CONST	Read only, value is constant
WPO	Read only, write preoperational

Table 9-3 Object Access Types

9.2 Objects

9.2.1 Device type 0x1000

This constant describes the device type. The lower word is the supported device profile number. The value 0x0192 (402) means that the device follows the CiA402 Device Profile Drives and Motion Control. The higher word holds information about the drive type. The value 0x0004 means that the drive is a stepper drive.

Attribute	Value	
Name	Device Type	
Index	0x1000	
Subindex	0x00	
Type	UNSIGNED32	
Access	RO	
Default Value	0x00040192	
Value range	-	-

Table 9-4 Object 0x1000 Device Type

9.2.2 Error Register 0x1001

The device maps internal errors in this byte. For a detailed error description user can read Error Code Object 0x603F.

Attribute	Value	
Name	Error Register	
Index	0x1001	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Default Value	0	
Value range	-	-

Table 9-5 Object 0x1001 Error Register

Bit	Description
7	Motion Error
6	Reserved
5	Profile specific
4	Communication Error
3	Overtemperature Error
2	Voltage Error
1	Current Error
0	Generic Error

Table 9-6 Error Register Bits

9.2.3 Manufacturer Device Name 0x1008

Product name: “HT7x0_ECAT”

Attribute	Value	
Name	Manufacturer Device Name	
Index	0x1008	
Subindex	0x00	
Type	VISIBLE_STRING	
Access	RO	
Default Value	“HT7x0_ECAT”	
Value range	-	-

Table 9-7 Object 0x1008 Manufacturer Device Name

9.2.4 Hardware Version Object 0x1009

This object contains Hardware version’s number.

Attribute	Value
Name	Hardware Version
Index	0x1009
Subindex	0x00
Type	VISIBLE_STRING
Access	RO

Attribute	Value	
Default Value	-	
Value range	-	-

Table 9-8 Object 0x1009 Hardware Version

9.2.5 Software Version Object 0x100A

This object contains Hardware version's number.

Attribute	Value	
Name	Software Version	
Index	0x100A	
Subindex	0x00	
Type	VISIBLE_STRING	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-9 Object 0x100A Software Version

9.2.6 Identity Object 0x1018

This object contains SHS vendor identification number, assigned by ETG, the product code, HW version and SW version.

Attribute	Value
Name	Identity Object
Index	0x1018
Entries	4
Type	RECORD

Table 9-10 Object 0x1018 Identity Object

Attribute	Value	
Name	Vendor ID	
Index	0x1018	
Subindex	0x01	
Type	UNSIGNED32	
Access	RO	
Default Value	0x000n09AD	
Value range	-	-

Table 9-11 Object 0x1018 sub1 Vendor ID

High word contains the HW version. The low word contains the application number of the version array.

Attribute	Value
Name	Product Code
Index	0x1018

Attribute	Value	
Subindex	0x02	
Type	UNSIGNED32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-12 Object 0x1018 sub2 Product Code

The high word contains the software version. The low word contains the application version of the version array.

Attribute	Value	
Name	Revision Number	
Index	0x1018	
Subindex	0x03	
Type	UNSIGNED32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-13 Object 0x1018 sub3 Revision Number

Contains the last 8 digits of the device serial number in hex format.

Attribute	Value	
Name	Serial Number	
Index	0x1018	
Subindex	0x04	
Type	UNSIGNED32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-14 Object 0x1018 sub4 Serial Number

9.2.7 Error Settings Object 0x10F1

See Ethercat specs.

Attribute	Value
Name	Error Settings Object
Index	0x10F1
Entries	2
Type	RECORD

Table 9-15 Object 0x10F1 Error Setting Object

Attribute	Value
Name	Local Error Reaction
Index	0x10F1
Subindex	0x01
Type	UNSIGNED32

Attribute	Value	
Access	RW	
Default Value	1	
Value range	-	-

Table 9-15 Object 0x10F1 sub1 Local Error Reacrion

Attribute	Value	
Name	Sync Error Counter Limit	
Index	0x10F1	
Subindex	0x02	
Type	UNSIGNED16	
Access	RW	
Default Value	4	
Value range	-	-

Table 9-16 Object 0x10F1 sub2 Sync Error Counter Limit

9.2.8 Receive PDO 1 Mapping Object 0x1600

PDO mapping can be changed. Thereby, subindex 0 represents the number of mapped objects, whereas subindex 0x01…0x0n represents the mapped objects.

Attribute	Value	
Name	Receive PDO 1 Mapping	
Index	0x1600	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	1	
Value range	-	-

Sub-index	Access	Default value	Mapped Object
0x01	RW	0x60400010	Controlword

Table 9-17 Receive PDO 1 Mapping

9.2.9 Receive PDO 256 Mapping Object 0x1700

PDO mapping is static and cannot be changed. Thereby, subindex 0 represents the number of mapped objects, whereas subindex 0x01…0x0n represents the mapped objects.

Attribute	Value
Name	Receive PDO 256 Mapping
Index	0x1700
Subindex	0x00

Attribute	Value	
Type	UNSIGNED8	
Access	RO	
Default Value	8	
Value range	-	-

Sub-index	Access	Default value	Mapped Object
0x01	RO	0x60400010	Controlword
0x02	RO	0x607A0020	Target position
0x03	RO	0x60FF0020	Target Velocity
0x04	RO	0x60830020	Profile acceleration
0x05	RO	0x60810020	Profile velocity
0x06	RO	0x60980008	Homing Method
0x07	RO	0x60600008	Modes of operation
0x08	RO	0x20790110	Digital Outputs Functionalities State

Table 9-18 Receive PDO 256 Mapping

9.2.10 Transmit PDO 1 Mapping Object 0x1A00

PDO mapping can be changed. Thereby, subindex 0 represents the number of mapped objects, whereas subindex 0x01…0x0n represents the mapped objects.

Attribute	Value	
Name	Transmit PDO 1 Mapping	
Index	0x1A00	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	1	
Value range	-	-

Sub-index	Access	Default value	Mapped Object
0x01	RO	0x60410010	Statusword

Table 9-21 Transmit PDO 1 Mapping

9.2.11 Transmit PDO 2 Mapping Object 0x1B00

PDO mapping is static and cannot be changed. Thereby, subindex 0 represents the number of mapped objects, whereas subindex 0x01…0x0n represents the mapped objects.

Attribute	Value	
Name	Transmit PDO 256 Mapping	
Index	0x1B00	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Default Value	7	
Value range	-	-

Sub-index	Access	Default value	Mapped Object
0x01	RO	0x60410010	Statusword
0x02	RO	0x60640020	Position actual value
0x03	RO	0x606C0020	Velocity Actual Value
0x04	RO	0x60610008	Modes of operation display
0x05	RO	0x20710110	Digital Inputs Functionalities State
0x06	RO	0x20300020	Encoder Counts
0x07	RO	0x603F0010	Error Code

Table 9-22 Transmit PDO 256 Mapping

9.2.12 Sync Manager Communication Type Object 0x1C00

From this object it is possible to read out the transfer mode of the EtherCAT Sync Manager's channels.

Attribute	Value
Name	Sync Manager Communication Type
Index	0x1C00
Entries	4
Type	RECORD

Table 9-25 Sync Manager Communication Type

Attribute	Value	
Name	Number of used Sync Manager Channels	
Index	0x1C00	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Default Value	4	
Value range	-	-

Table 9-26 Number of used Sync Manager Channels

Attribute	Value
Name	Communication Type Sync Channel 0
Index	0x1C00

Attribute	Value
Subindex	0x01
Type	UNSIGNED8
Access	RO
Default Value	1: Mailbox Receive (Master -> Slave)

Table 9-27 Communication Type Sync Channel 0

Attribute	Value
Name	Communication Type Sync Channel 1
Index	0x1C00
Subindex	0x02
Type	UNSIGNED8
Access	RO
Default Value	2: Mailbox Transmit (Master <- Slave)

Table 9-28 Communication Type Sync Channel 1

Attribute	Value
Name	Communication Type Sync Channel 2
Index	0x1C00
Subindex	0x03
Type	UNSIGNED8
Access	RO
Default Value	3: Process Data Output (Master -> Slave)

Table 9-29 Communication Type Sync Channel 2

Attribute	Value
Name	Communication Type Sync Channel 3
Index	0x1C00
Subindex	0x04
Type	UNSIGNED8
Access	RO
Default Value	4: Process Data Input (Master <- Slave)

Table 9-30 Communication Type Sync Channel 3

9.2.13 Sync Manager Channel 2 (RxPDO) Object 0x1C12

This object is used to configure a PDO for Sync channel 2 (Master to Slave). Only one PDO can be assigned. Sub-index 0 value represents the number of PDOs assigned to the Sync channel, while sub-index 1 indicates the PDO object. Prior to assign the PDO, Number of assigned PDOs must be set to 0.

Attribute	Value
Name	Sync Manager Channel 2 (PDO)
Index	0x1C12
Entries	2
Type	RECORD

Table 9-31 Sync Manager Channel 2

Attribute	Value	
Name	Number of assigned PDOs	
Index	0x1C12	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	1	
Value range	1	1

Table 9-32 Number of assigned PDOs

Attribute	Value	
Name	PDO Mapping Object Number of assigned RxPDO	
Index	0x1C12	
Subindex	0x01	
Type	UNSIGNED16	
Access	RW	
Default Value	0x1600	
Value range	0x1600	0x1603

Table 9-33 PDO Mapping Object Number of assigned RxPDO

9.2.14 Sync Manager Channel 3 (TxPDO) Object 0x1C13

This object is used to configure a PDO for Sync channel 3 (Slave to Master). Only one PDO can be assigned. Sub-index 0 value represents the number of PDOs assigned to the Sync channel, while sub-index 1 indicates the PDO object. Prior to assign the PDO, Number of assigned PDOs must be set to 0.

Attribute	Value
Name	Sync Manager Channel 3 (PDO)
Index	0x1C13
Entries	2
Type	RECORD

Table 9-34 Sync Manager Channel 3

Attribute	Value	
Name	Number of assigned PDOs	
Index	0x1C13	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	1	
Value range	1	1

Table 9-35 Number of assigned PDOs

Attribute	Value
Name	PDO Mapping Object Number of assigned TxPDO
Index	0x1C13

Attribute	Value	
Subindex	0x01	
Type	UNSIGNED16	
Access	RW	
Default Value	0x1A00	
Value range	0x1A00	0x1A03

Table 9-36 PDO Mapping Object Number of assigned TxPDO

9.2.15 Phase Current Object 0x2010

The object set up the desired motor phase current, maximum value depends on the drive hardware version.

Attribute	Value	
Name	Phase Current	
Index	0x2010	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	0x03E8 (1000)	
Value range	0	Device dependent
Units	mA	

Table 9-37 Phase Current

9.2.16 Phase Current Reduction Object 0x2011

The object set up the desired current reduction when the motor is still, refer to Table 9-39 for value selection.

Attribute	Value	
Name	Phase Current Reduction	
Index	0x2011	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	0x02	
Value range	0x00	0x03

Table 9-38 Phase Current Reduction

Register Value	Reduction value
0x00	Max reduction (phase current = 0)
0x01	No reduction
0x02	25% reduction

Register Value	Reduction value
0x03	50% reduction

Table 9-39 Current Reduction Values

9.2.17 Phase Current Reduction Time Object 0x2012

The object set up the time interval between the motor stop and the current reduction activation.

Attribute	Value	
Name	Phase Current Reduction Time	
Index	0x2012	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	0x0A	
Value range	0x00	0xFF (255)
Units	ms	

Table 9-40 Phase Current Reduction Time

9.2.18 Low Noise Mode Object 0x2013

The object establishes if the low noise function of the drive is active or not.

Attribute	Value	
Name	Low Noise Mode	
Index	0x2013	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	0x0A	
Possible values	0x00 (Disabled)	0x02 Enabled

Table 9-41 Low Noise Mode

9.2.19 Min Frequency Object 0x2018

The value represents the starting stepping frequency of the drive

Attribute	Value
Name	Min Frequency
Index	0x2018

Attribute	Value	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0001	
Value range	0x0001	0x2710 (10,000)
Units	Hz	

Table 9-42 Min Frequency

9.2.20 Drive Temperature Object 0x2020

Drive internal temperature value.

Attribute	Value	
Name	Drive Temperature	
Index	0x2020	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Default Value	0	
Value range	-	-
Units	°C	

Table 9-43 Drive Temperature

9.2.21 Encoder Counts Object 0x2030

The object shows the number of the encoder counts in 4xCPR.

Attribute	Value	
Name	Encoder Counts	
Index	0x2030	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	0	
Value range	-	-
Units	4xCPR	

Table 9-44 Encoder Counts

9.2.22 Encoder Configuration Object 0x2032

The object configures the encoder mode and the resolution (counts per revolution).

The encoder modalities are explained on Table 9-47 Encoder modes.

Attribute	Value
Name	Encoder Configuration
Index	0x2032
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x02

Table 9-45 Encoder Configuration

Attribute	Value	
Name	Encoder Mode	
Index	0x2032	
Subindex	0x01	
Type	UNSIGNED16	
Access	RW	
Default Value	0	
Value range	0	2

Table 9-46 Encoder Mode Sub-Index

Value	Description
0	Open loop, Encoder counts can be read
1	Positioning made with encoder feedback, no stop error generate
2	Encoder feedback used to check positioning error, stop error generate

Table 9-47 Encoder modes

Attribute	Value	
Name	Encoder Resolution	
Index	0x2032	
Subindex	0x02	
Type	UNSIGNED16	
Access	RW	
Default Value	1024	
Value range	16	65535
Units	CPR	

Table 9-48 Encoder Resolution Sub-Index

9.2.23 Encoder Fault Steps Object 0x2034

The value establishes the difference between encoder position and theoretical position that rises a positioning error. When the encoder mode is set to 2 and this difference is crossed, the drive immediately stops the movement and rises a positioning error.

Attribute	Value	
Name	Encoder Fault Steps	
Index	0x2034	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	0xFFFF	
Value range	0	0xFFFF
Units	CPR	

Table 9-49 Encoder Fault Steps

9.2.24 Digital Inputs Configuration Object 0x2070

The object assigns the functionality for each configurable input.

The configurable inputs are IN1, IN2 and IN3, so the number of subindex is 3 and the “n” value in table is in the range 1 – 3.

Attribute	Value
Name	Digital Inputs Configuration
Index	0x2070
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x03

Table 9-50 Digital Inputs Configuration

Attribute	Value	
Name	Function of Digital Input n	
Index	0x2070	
Subindex	0x0n	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0001 (IN1), 0x0002 (IN2), 0x0800(IN3)	
Value range	0x0000	0xFFFF

Table 9-51 Function of Digital Input n

Bit	Value	Functionality	Description
0	0x0001	Negative limit switch	Used in some homing modes
1	0x0002	~~Positive Limit Switch~~	Used in some homing modes (N.A. yet)
2	0x0004	~~Home Switch~~	Used in some homing modes (N.A. yet)
3	0x0008	~~Zerofly~~	Flying zero trigger (N.A.)
4	0x0010	Touch Probe 1	Touch Probe input
5	0x0020	~~Step In~~	Step signal input (N.A.)

Bit	Value	Functionality	Description
6	0x0040	~~Direction~~	Direction signal input (N.A.)
7	0x0080	~~Current Reduction~~	Current reduction enabled signal input (N.A.)
8	0x0100	~~Quick Stop~~	Quick stop signal input (N.A.)
9	0x0200	General purpose input 1	State can be read
10	0x0400	General purpose input 2	State can be read
11	0x0800	General purpose input 3	State can be read
12	0x1000	General purpose input 4	State can be read
13	0x2000	~~Trigger start~~	Start trigger signal input (N.A.)
14	0x4000	~~Trigger stop~~	Stop trigger signal input (N.A.)
15	0x8000	~~Trigger Home~~	Home trigger signal input (N.A.)

Table 9-52 Digital Inputs Functions

9.2.25 Digital Inputs Functionalities Object 0x2071

With the object sub-index *Digital Inputs Functionalities State*, the state of each function can be read, *Digital Inputs Functionalities Mask* can mask the general-purpose inputs, while *Digital Inputs Functionalities Polarity* sets the polarity for each function.

Attribute	Value
Name	Digital Inputs Functionalities
Index	0x2071
Subindex	0x00
Type	RECORD
Access	RO/RW
Default Value	0x03

Table 9-53 Digital Inputs Functionalities

Attribute	Value	
Name	Digital Inputs Functionalities State	
Index	0x2071	
Subindex	0x01	
Type	UNSIGNED16	
Access	RO	
Default Value	0x0000	
Value range	0x0000	0xFFFF

Table 9-54 Digital Inputs Functionalities State

Attribute	Value
Name	Digital Inputs Functionalities Mask
Index	0x2071
Subindex	0x02
Type	UNSIGNED16
Access	RW
Default Value	0x0000

Attribute	Value	
Value range	0x0000	0xFFFF

Table 9-55 Digital Inputs Functionalities Mask

Attribute	Value	
Name	Digital Inputs Functionalities Polarity	
Index	0x2071	
Subindex	0x03	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0000	
Value range	0x0000	0xFFFF

Table 9-56 Digital Inputs Functionalities Polarity

9.2.26 Digital Outputs Configuration Object 0x2078

The object assigns the functionality for each configurable output.

The configurable outputs are OUT1, OUT2 and OUT3.

Attribute	Value
Name	Digital Outputs Configuration
Index	0x2078
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x02

Table 9-57 Digital Outputs Configuration

Attribute	Value	
Name	Function of Digital Output 1	
Index	0x2078	
Subindex	0x01	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0002	
Value range	0x0000	0xFFFF

Table 9-58 Function of Digital Output 1

Attribute	Value
Name	Function of Digital Output 2
Index	0x2078
Subindex	0x02
Type	UNSIGNED16
Access	RW
Default Value	0x0004

Attribute	Value	
Value range	0x0000	0xFFFF

Table 9-59 Function of Digital Output 2

Attribute	Value	
Name	Function of Digital Output 3	
Index	0x2078	
Subindex	0x03	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0000	
Value range	0x0000	0xFFFF

Table 9-60 Function of Digital Output 3

Bit	Value	Description
0	0	Enable mode (bits [1..15])
	1	Command direct the output, enable SDO 2079
[1 to 15]	1	Ready state mode
	2	Run stare mode
	Others value	Output disable

Table 9-61 Digital Outputs Functions

9.2.27 Digital Outputs Functionalities Object 0x2079

With the object sub-index *Digital Outputs Functionalities State*, the state of general-purpose outputs can be set, *Digital Outputs Functionalities Mask* can mask the general-purpose outputs.

Attribute	Value
Name	Digital Outputs Functionalities
Index	0x2079
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x03

Table 9-62 Digital Outputs Functionalities

Attribute	Value	
Name	Digital Outputs Functionalities State	
Index	0x2079	
Subindex	0x01	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0000	
Value range	0x0000	0xFFFF

Table 9-63 Digital Outputs Functionalities State

Attribute	Value	
Name	Digital Outputs Functionalities Mask	
Index	0x2079	
Subindex	0x02	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0000	
Value range	0x0000	0xFFFF

Table 9-64 Digital Outputs Functionalities Mask

- OUT1 -> bit 9 (to set 1 and enable write 0x0200)
- OUT2 -> bit 10 (to set 1 and enable write 0x0400)
- OUT3 -> bit 11 (to set 1 and enable write 0x0800)

9.2.28 Error Code Object 0x603F

The value represents the error condition of the drive, as described in Table 9-66.

Attribute	Value	
Name	Error Code	
Index	0x603F	
Subindex	0x00	
Type	UNSIGNED16	
Access	RO	
Default Value	0	
Value range	-	-

Table 9-65 Error Code

Error Code	Meaning
0x2230	Short circuit
0x3210	DC link over-voltage
0x3220	DC link under-voltage
0x4210	Excess temperature device
0x5440	Contact Error (Disable HW)
0x7120	Motor Error
0x7121	Motor blocked error (Encoder)

Table 9-66 Error Code

9.2.29 Controlword Object 0x6040

Controlwords consists of bits related to:

- Device Control Commands (bits 0 to 3 and 7)
- Operating modes specific bits (bits 4, 5, 6, 8), as summarized in Table 9-68
    - Controlword Profile Position mode-specific bits
    - Controlword Profile Velocity mode-specific bits
    - Controlword Homing mode mode-specific bits

Attribute	Value	
Name	Controlword	
Index	0x6040	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	-	
Value range	-	-

Table 9-67 Controlword

Bit	Description	PPM	PVM	HM
15-11	Reserved	-	-	-
10, 9	Reserved	-		-
8	Operating mode specific	Halt	Halt	Halt
7	Fault reset			
6	Operating mode specific	Abs/Rel positioning	reserved	reserved
5	Operating mode specific	reserved	reserved	reserved
4	Operating mode specific	New setpoint	reserved	Homing start
3	Enable operation			
2	Quickstop			
1	Enable voltage			
0	Switch on			

Table 9-68 Controlword bits

9.2.30 Statusword Object 0x6041

Statuswords consists of bits related to:

- Device Control CommandsDrive State (bits 0 to 3, 8 and 14)
- Operating modes specific bits (bits 10, 12, 13), as summarized in Table 9-70.
    - Statusword Profile Position mode-specific bits
    - Statusword Profile Velocity mode-specific bits
    - Statusword Homing mode mode-specific bits

Attribute	Value	
Name	Statusword	
Index	0x6041	
Subindex	0x00	
Type	UNSIGNED16	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-69 Statusword

Bit	Description	PPM	PVM	HM
15-14	reserved	-	-	-
13	Operating mode specific	Following Error	Maximum slippage reached	Homing error
12	Operating mode specific	Setpoint ack	Speed	Homing attained
11	Internal limit active			
10	Operating mode specific	Target reached	Target reached	Target reached
9	Remote			
8	Reserved	-	-	-
7	Warning			
6	Switch on disabled			
5	Quickstop			
4	Voltage enabled			
3	Fault			
2	Operation enabled			
1	Switched on			
0	Ready to switch on			

Table 9-70 Statusword bits

9.2.31 Quick Stop Option Code Object 0x605A

The value describes the behavior of the drive when the quick stop function is executed. Table 9-72 lists the available functions.

Attribute	Value	
Name	Quick Stop Option Code	
Index	0x605A	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Default Value	0x0000	
Value range	0	8

Table 9-71 Quick Stop Option Code

Value	Description
0	Disable Drive
1-8	NA

Table 9-72 Quick Stop Option Code functions

9.2.32 Shutdown Option Code Object 0x605B

The value describes the behavior of the drive when a transition from *Operation Enabled* state to *Ready to Switch On* state is performed. Table 9-74 lists the available functions.

Attribute	Value	
Name	Shutdown Option Code	
Index	0x605B	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Default Value	0x0000	
Value range	-	-

Table 9-73 Shutdown Option Code

Value	Description
0	Disable drive function (switch-off the drive power stage)
1	NA

Table 9-74 Shutdown Option Code functions

9.2.33 Disable Operation Option Code Object 0x605C

The value describes the behavior of the drive when a transition from *Operation Enabled* state to *Switched On* state is performed. Table 9-76 lists the available functions.

Attribute	Value	
Name	Disable Operation Option Code	
Index	0x605C	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Default Value	0x0000	
Value range	-	-

Table 9-75 Disable Operation Option Code

Value	Description
0	Disable drive function (switch-off the drive power stage)
1	NA

Table 9-76 Disable Operation Option Code functions

9.2.34 Modes of Operation Object 0x6060

The parameter is used to switch between the available operating modes. Control device can check the active operating modes with Modes of Operation Display Object 0x6061.

Attribute	Value
Name	Modes of Operation
Index	0x6060
Subindex	0x00
Type	INTEGER8
Access	RW
Default Value	1
Value range	See Table 9-78

Table 9-77 Modes of Operation

Operation Mode	Description
1	Profile position mode (pp)
3	Profile velocity mode (pv)
6	Homing mode (hm)

Table 9-78 Modes of Operation

9.2.35 Modes of Operation Display Object 0x6061

The value represents the actual modes of operation, the legend is in Table 9.

Attribute	Value
Name	Modes of Operation Display
Index	0x6061
Subindex	0x00
Type	INTEGER8
Access	RO
Default Value	1
Value range	See Table 9-78

Table 9-79 Modes of Operation Display

9.2.36 Position Demand Value Object 0x6062

The value represents the demanded position value in user defined position units.

Attribute	Value	
Name	Position Demand Value	
Index	0x6062	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-80 Position Demand Value

9.2.37 Position Actual Internal Value Object 0x6063

The value represents the actual position in internal units.

Attribute	Value	
Name	Position Actual Internal Value	
Index	0x6063	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-81 Position Actual Internal Value

9.2.38 Position Actual Value Object 0x6064

The object provides the actual position value in user-defined position unit.

Attribute	Value	
Name	Position Actual Value	
Index	0x6064	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-81 Position Actual Value

9.2.39 Velocity Demand Value Object 0x606B

The object represents the velocity setpoint in user units.

Attribute	Value	
Name	Velocity Demand Value	
Index	0x606B	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-81 Velocity Demand Value

9.2.40 Velocity Actual Value Object 0x606C

The value represents the actual velocity in user-defined units.

Attribute	Value	
Name	Velocity Actual Value	
Index	0x606C	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	-	
Value range	-	-

Table 9-82 Velocity Actual Value

9.2.41 Velocity Window Object 0x606D

The value represents speed validation range (pv mode).

Attribute	Value	
Name	Velocity Window	
Index	0x606D	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	0	
Value range	0	65535

Table 9-83 Velocity Window

9.2.42 Velocity Window Time Object 0x606E

The value unit is millisecond

Attribute	Value	
Name	Velocity Window time	
Index	0x606E	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	0	
Value range	0	65535

Table 9-84 Velocity WindowTime

9.2.43 DC Link Circuit Voltage Object 0x6079

The value represents the actual voltage of the DC bus.

Attribute	Value
Name	DC Link Circuit Voltage
Index	0x6079
Subindex	0x00
Type	UNSIGNED16
Access	RO
Default Value	-
Unit	V

Table 9-85 DC Link Circuit Voltage

9.2.44 Target Position Object 0x607A

The value represents the position setpoint when the drive is in Profile position mode (pp). The movement will be executed according to the Profile Velocity Object 0x6081 and Profile Acceleration Object 0x6083. The setpoint can be absolute or relative, by setting the appropriate bit on the *Controlword*, as specified in Controlword Profile Position mode-specific bits.

Attribute	Value
Name	Target Position
Index	0x607A
Subindex	0x00

Attribute	Value	
Type	INTEGER32	
Access	RW	
Default Value	0	
Unit	V	
Value range	-	-

Table 9-86 Target Position

9.2.45 Home Offset Object 0x607C

The value indicates the difference between the zero and the home position. When the homing method is Homing Method 37 (Homing on current position), the Actual Position after the homing will be as follow:

$$Position\ Actual\ Value\ (0x6064) = Home\ \ Offset\ (0x6074)$$

When the method is set to Homing Method 17 (Negative Limit Switch), the drive will move away from the sensor of the offset quantity.

Attribute	Value	
Name	Home Offset	
Index	0x607C	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Default Value	0	
Value range	-	-

Table 9-87 Home Offset

9.2.46 Software Position Limit Object 0x607D

The object contains the maximum and minimum values for the Target Position Object 0x607A.

If the values are set to '0' the limits will be disabled.

Attribute	Value
Name	Software Position Limit
Index	0x607D
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x02

Table 9-88 Software Position Limit

Attribute	Value	
Name	Min Position Limit	
Index	0x607D	
Subindex	0x01	
Type	INTEGER32	
Access	RW	
Default Value	0	
Value range	-	-

Table 9-89 Min Position Limit

Attribute	Value	
Name	Max Position Limit	
Index	0x607D	
Subindex	0x02	
Type	INTEGER32	
Access	RW	
Default Value	0	
Value range	-	-

Table 9-90 Max Position Limit

9.2.47 Polarity Object 0x607E

The Polarity byte is composed as shown on Table 9-92 and the polarity bits meaning is shown in Table 9-93. When the operation mode is set to Profile position mode (pp), only the Velocity Polarity bit shall be used, while the Position Polarity bit shall be used when the drive is on Profile velocity mode (pv). It is recommended that Velocity and Position Polarity bits have the same value.

Attribute	Value	
Name	Polarity	
Index	0x607E	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Default Value	0	
Value range	0	0xC0

Table 9-91 Polarity

Bit	Description
7	Position Polarity
6	Velocity Polarity
5 – 0	Reserved (0)

Table 9-92 Polarity Byte structure

Value	Description
0	Multiply by 1
1	Multiply by -1

Table 9-93 Polarity bits description

9.2.48 Max Profile Velocity Object 0x607F

The value sets the maximum value of the Profile Acceleration Object 0x6083.

Attribute	Value	
Name	Max Profile Velocity	
Index	0x607F	
Subindex	0x00	
Type	UNSIGNED32	
Access	RW	
Default Value	0x4E20 (20,000)	
Value range	1	-

Table 9-94 Max Profile Velocity

9.2.49 Profile Velocity Object 0x6081

The value sets the target speed of the drive when Profile position mode (pp) is active.

Attribute	Value	
Name	Profile Velocity	
Index	0x6081	
Subindex	0x00	
Type	UNSIGNED32	
Access	RW	
Default Value	0x0200 (512)	
Value range	1	-

Table 9-95 Profile Velocity

9.2.50 Profile Acceleration Object 0x6083

The value sets the acceleration of the motor when Profile position mode (pp) or Profile velocity mode (pv) are active.

Attribute	Value	
Name	Profile Acceleration	
Index	0x6083	
Subindex	0x00	
Type	UNSIGNED32	
Access	RW	
Default Value	0x0010 (16)	
Value range	1	0x00FF (255)

Table 9-95 Profile Acceleration

9.2.51 Gear Ratio Object 0x6091

The object indicates the number of motor shaft revolution and number of driving shaft revolution.

The gear ratio is calculated as below.

$$Gear\,Ratio = \frac{motor\ shaft\ revolutions}{driving\ shaft\ revolutions}$$

Attribute	Value
Name	Gear Ratio
Index	0x6091
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x02

Table 9-96 Gear Ratio

Attribute	Value	
Name	Motor Revolutions	
Index	0x6091	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Default Value	0x0001	
Value range	0x0001	0xFFFF

Table 9-97 Motor Revolutions

Attribute	Value
Name	Shaft Revolutions
Index	0x6091
Subindex	0x02
Type	UNSIGNED32

Attribute	Value	
Access	RW	
Default Value	0x0001	
Value range	0x0001	0xFFFF

Table 9-98 Shaft Revolutions

9.2.52 Feed Constant Object 0x6092

The object indicates the feed constant, that is the measured distance per one output shaft revolution. Feed constant is calculated as below.

$$Feed\ constant = \frac{feed}{shaft\ revolutions}$$

Attribute	Value
Name	Feed Constant
Index	0x6092
Subindex	0x00
Type	RECORD
Access	RW
Default Value	0x02

Table 9-99 Feed Constant

Attribute	Value	
Name	Feed	
Index	0x6092	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Default Value	0x0001	
Value range	0x0001	0xFFFF

Table 9-100 Feed

Attribute	Value	
Name	Shaft Revolutions	
Index	0x6092	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Default Value	0x0001	
Value range	0x0001	0xFFFF

Table 9-101 Shaft Revolutions

9.2.53 Homing Method Object 0x6098

The object defines the homing method to be used, among the supported ones, as stated in Supported Homing Methods Object 0x60E3.

Attribute	Value	
Name	Homing Method	
Index	0x6098	
Subindex	0x00	
Type	INTEGER8	
Access	RW	
Default Value	0x00	
Value range	0x00	0x25

Table 9-102 Homing Method

9.2.54 Homing Speeds Object 0x6099

The object's values set the speeds that the motor will have during the homing procedure, more in detail, the speed during the switch search and the zero search. The search for zero speed is also used for the limit switch disengagement.

Attribute	Value
Name	Homing Speeds
Index	0x6099
Subindex	0x00
Type	ARRAY
Access	RW
Default Value	2

Table 9-103 Homing Speeds

Attribute	Value
Name	Speed during search for switch
Index	0x6099
Subindex	0x01
Type	UNSIGNED32
Access	RW
Default Value	0x0050

Table 9-104 Speed during search for switch

Attribute	Value
Name	Speed during search for zero
Index	0x6099
Subindex	0x02
Type	UNSIGNED32

Attribute	Value
Access	RW
Default Value	0x0050

Table 9-105 Speed during search for zero

9.2.55 Homing Acceleration Object 0x609A

Attribute	Value	
Name	Homing Acceleration	
Index	0x609A	
Subindex	0x00	
Type	UNSIGNED32	
Access	RW	
Default Value	0x0100	
Value range	0x0001	0x00FF

Table 9-106 Homing Acceleration

9.2.56 Touch Probe Function Object 0x60B8

The object configures the behavior of the touch probe. The bits meaning are shown in Table 9-108.

Attribute	Value	
Name	Touch Probe Function	
Index	0x60B8	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Default Value	0x0000	
Value range	-	-

Table 9-107 Touch Probe Function

Bit	Value	Description
0	0	Disable touch probe 1
	1	Enable touch probe 1
1	0	Trigger only first event
	1	Continuous
2, 3	00	Trigger with touch probe 1 input (N.A.)
	01	Trigger with zero impulse signal or position encoder
	10	Touch probe source defined by object 0x60D0
	11	Reserved
4	0	Disable sampling at rising edge of touch probe 1
	1	Enable sampling at rising edge of touch probe 1
5	0	Disable sampling at falling edge of touch probe 1

Bit	Value	Description
	1	Enable sampling at falling edge of touch probe 1
6, 7	-	Reserved
8…15	-	Not used

Table 9-108 Touch Probe configuration bits

9.2.57 Touch Probe Status Object 0x60B9

The object indicates the status of the touch probe. User shall check this object before reading the touch probe values. The bits are explained in Table 9-111.

Attribute	Value	
Name	Touch Probe Status	
Index	0x60B9	
Subindex	0x00	
Type	UNSIGNED16	
Access	RO	
Default Value	0x0000	
Value range	-	-

Table 9-110 Touch Probe Status

Bit	Value	Description
0	0	Touch probe 1 disabled
	1	Touch probe 1 enabled
1	0	No positive edge position stored (touch probe 1)
	1	Positive edge position stored (touch probe 1)
2	0	No negative edge position stored (touch probe 1)
	1	Negative edge position stored (touch probe 1)
3…5	0	Reserved
6,7	-	Not used
8…15	0	Not used

Table 9-111 Touch Probe Status bits

9.2.58 Touch Probe Position 1 Positive Value Object 0x60BA

The object provides the position value of the touch probe 1 when the rising edge has been detected.

Attribute	Value
Name	Touch Probe Position 1 Positive Value
Index	0x60BA

Attribute	Value	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	0x0000	
Value range	-	-

Table 9-112 Touch Probe Position 1 Positive Value

9.2.59 Touch Probe Position 1 Negative Value Object 0x60BB

The object provides the position value of the touch probe 1 when the falling edge has been detected.

Attribute	Value	
Name	Touch Probe Position 1 Negative Value	
Index	0x60BB	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	0x0000	
Value range	-	-

Table 9-113 Touch Probe Position 1 Negative Value

9.2.60 Touch Probe 1 Positive Edge Counter Object 0x60D5

If the touch probe is enabled, this object provides a counter of the detected rising edges of the touch probe 1. The counter is cleared when the Touch Probe Function Object 0x60B8 disables the probe.

Attribute	Value	
Name	Touch Probe 1 Positive Edge Counter	
Index	0x60D5	
Subindex	0x00	
Type	UNSIGNED16	
Access	RO	
Default Value	0x0000	
Value range	-	-

Table 9-114 Touch Probe 1 Positive Edge Counter

9.2.61 Touch Probe 1 Negative Edge Counter Object 0x60D6

If the touch probe is enabled, this object provides a counter of the detected falling edges of the touch probe 1. The counter is cleared when the Touch Probe Function Object 0x60B8 disables the probe.

Attribute	Value	
Name	Touch Probe 1 Negative Edge Counter	
Index	0x60D6	
Subindex	0x00	
Type	UNSIGNED16	
Access	RO	
Default Value	0x0000	
Value range	-	-

Table 9-115 Touch Probe 1 Negative Edge Counter

9.2.62 Supported Homing Methods Object 0x60E3

The object lists the supported homing method of the drive.

Attribute	Value
Name	Supported Homing Methods
Index	0x60E3
Subindex	0x00
Type	ARRAY
Access	RO
Default Value	3

Table 9-116 Supported Homing Methods

Attribute	Value
Name	Supported Homing Method 1
Index	0x60E3
Subindex	0x01
Type	INTEGER8
Access	R0
Default Value	0x01 (1)

Table 9-117 Supported Homing Method 1

Attribute	Value
Name	Supported Homing Method 2
Index	0x60E3
Subindex	0x02
Type	INTEGER8
Access	R0
Default Value	0x11 (17)

Table 9-118 Supported Homing Method 2

Attribute	Value
Name	Supported Homing Method 3
Index	0x60E3
Subindex	0x03
Type	INTEGER8
Access	R0
Default Value	0x25 (37)

Table 9-119 Supported Homing Method 3

9.2.63 Motor Resolution Object 0x60EF

This object sets the motor resolution. The value represents the number of step needed to complete a motor revolution with a 200step/rev motor.

Attribute	Value	
Name	Motor Resolution	
Index	0x60EF	
Subindex	0x00	
Type	UNSIGNED32	
Access	RW	
Default Value	25600 (0x6400)	
Value range see Table 9-121 for possible values	200	25600

Table 9-120 Motor Resolution

Value	Step resolution
200	Full-step
400	Half-step 1/2
800	1/4 step
1600	1/8 step
3200	1/16 step
6400	1/32 step
12800	1/64 step
25600	1/128 step
500	1/2.5 step
1000	1/5 step
2000	1/10 step
4000	1/20 step
10000	1/50 step
20000	1/100 step

Table 121 Motor Resolution Description

9.2.64 Position Demand Internal Value Object 0x60FC

The object provides the set-point in internal units.

Attribute	Value	
Name	Position Demand Internal Value	
Index	0x60FC	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Default Value	-	
Value range	-	-

Table 122 Position Demand Internal Value

9.2.65 Target Velocity Object 0x60FF

The object indicates the target velocity in user-defined units.

Attribute	Value	
Name	Target Velocity	
Index	0x60FF	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Default Value	0	
Value range	-	-

Table 123 Target Velocity

9.2.66 Supported Drive Modes Object 0x6502

The object provides the supported operating modes of the device, see Table 9-125

Attribute	Value	
Name	Supported Drive Modes	
Index	0x6502	
Subindex	0x00	
Type	UNSIGNED32	
Access	CONST	
Default Value	0x0125	
Value range	-	-

Table 124 Supported Drive Modes

Bit	Value	Description
31…10	0	Reserved
9	0	Cyclic synchronous torque mode (cst) (N.A.)
8	0	Cyclic synchronous Velocity mode (csv) (N.A.)
7	0	Cyclic synchronous position mode (csp) (N.A.)
6	0	Interpolated position mode (ip) (N.A.)
5	1	Homing mode (hm)
4	0	Reserved
3	0	Torque mode (N.A.)
2	1	Profile velocity mode (pv)
1	0	Velocity mode (N.A.)
0	1	Profile position mode (pp)

Table 9-125 Supported drive modes