
EtherCAT User Manual

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AMP & MOONS' Automation

Contents

1 Introduction.....	4
1.1 About this manual.....	4
1.2 Reference documents	4
1.3 Commonly used acronyms.....	4
1.4 Revisions.....	5
2 EtherCAT communication specification	7
2.1 Introduction to EtherCAT	7
2.2 EtherCAT protocol	7
2.3 CANopen over EtherCAT	8
2.4 EtherCAT addressing	9
2.5 EtherCAT slaver information	10
2.6 Distributed clock.....	10
2.7 EtherCAT state machine(ESM)	12
3 Motion control.....	13
3.1 Control the power drive system.....	13
3.2 Mode of operation	15
3.3 Profile position mode.....	16
3.3.1 General information.....	16
3.3.2 Main controlling object.....	16
3.3.3 Functional description	17
3.4 Profile velocity mode	21
3.4.1 General information.....	21
3.4.2 Main controlling object.....	21
3.4.3 Functional description	22
3.5 Profile torque mode (StepSERVO only).....	23
3.5.1 General information.....	23
3.5.2 Main controlling object.....	23
3.5.3 Functional description	24
3.6 Homing mode.....	25
3.6.1 General information.....	25
3.6.2 Main controlling object.....	25
3.6.3 Functional description	26
3.6.4 Method 1 and 2	26
3.6.5 Method 3 and 4	27
3.6.6 Method 5 and 6	27
3.6.7 Method 7 and 8	28
3.6.8 Method 9 and 10	28
3.6.9 Method 11 and 12.....	29
3.6.10 Method 13 and 14	29
3.6.11 Method 17 and 18.....	30
3.6.12 Method 19 and 20	30
3.6.13 Method 21 and 22	31
3.6.14 Method 23 and 24	31
3.6.15 Method 25 and 26	32
3.6.16 Method 27 and 28	32
3.6.17 Method 29 and 30	33
3.6.18 Method 33 and 34	33

3.6.19 Method 35	34
3.6.20 Method 37	34
3.6.21 Method -1	34
3.6.22 Method -2	34
3.6.23 Method -3	34
3.6.24 Method -4	34
3.7 Cyclic synchronous position mode	35
3.7.1 General information	35
3.7.2 Main controlling object.....	35
3.7.3 Functional description	36
3.8 Cyclic synchronous velocity mode	37
3.8.1 General information	37
3.8.2 Main controlling object.....	38
3.8.3 Functional description	38
3.9 Q program mode	39
3.9.1 General information	39
3.9.2 Normal Q execution.....	39
3.10 Touch probe	40
3.10.1 General information	40
3.10.2 Main control object	40
3.10.3 Functional description	40
3.10.4 Timing diagrafe	42
4 Object dictionary	43
4.1 CoE object dictionary description	43
4.2 Communication profile.....	43
4.3 Motion control profile	50
4.4 Manufacturer profile	65
4.5 Manufacturer parameter for StepSERVO.....	70
4.6 Manufacturer parameter for Stepper	81
5 Contact MOONS'	93

1 Introduction

1.1 About this manual

This manual provides the details of EtherCAT communication about MOONS' Stepper and StepSERVO drives. It is used for engineers or technicians that develop a motion control system with EtherCAT communication. It is necessary that the user should know both a basic EtherCAT protocol and this manual.

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.2 Reference documents

Hardware Manual of MOONS' drive

CiA 402

ETG 1000

ETG 6010

MOONS' Host Command Reference

1.3 Commonly used acronyms

100Base-Tx	100 MBit/s Ethernet on twisted pairs
AL	Application Layer
CAN	Controller Area Network
CANopen	Application layer protocol for the CAN bus
CoE	CANopen over EtherCAT
DC	Distributed Clocks Mechanism to synchronize EtherCAT slaves and master
DL	Data Link Layer
EMCY	Emergency Object
ESI	EtherCAT Slave Information
ESC	EtherCAT Slave Controller
ETG	EtherCAT Technology Group
PDO	Process Data Object
SDO	Service Data Object
XML	eXtensible Markup Language - used for the ESI file

1.4 Revisions

Data	Revisions	Changes
8/12/2020	2.1	Update and rectification

This manual mainly introduces the communication description of StepSERVO and Stepper drives.

Stepper drives:

Model	Firmware
STF03-EC	
STF05-EC	
STF06-EC	
STF10-EC	
STF05-ECX-H	
STF10-ECX-H	

StepSERVO drives:

Model	Firmware
SDDC03-EC	
SDDC06-EC	
SDDC10-EC	
SDDC06-ECX-H	
SDDC10-ECX-H	
SDDC06W-ECX-H	

OD	Name	SSDC**-EC	SSDC**-ECX-H	SSDC**-ECX-J	SSDC**W-EC-H
0x2036	Move Homeoffset		√	√	
0x2040	Qcontrolword		√	√	
0x2041	Qstatusword		√	√	
0x2230	Full closed-loop Mode	√	√	√	
0x2231	Secondary Encoder Resolution	√	√	√	
0x2240	Full closed-loop Position Gain	√	√	√	
0x2241	Full closed-loop PositionDeri Gain	√	√	√	
0x2242	Full closed-loop PositionDeri Filter	√	√	√	
0x2244	Full closed-loop Velocity Gain	√	√	√	
0x2245	Full closed-loop VelocityInteg Gain	√	√	√	
0x2246	Full closed-loop AccFeedForward	√	√	√	
0x2247	Full closed-loop PID Filter	√	√	√	
0x2250	Full closed-loop Cherk turns	√	√	√	
0x2251	Full closed-loop Turns Pos Error	√	√	√	
0x2265	E-Stop on Input X8		√	√	
0x22D5	Touch probe1 pos edge counter		√	√	
0x22D6	Touch probe1 neg edge counter		√	√	
0x22D7	Touch probe2 pos edge counter		√	√	
0x22D8	Touch probe2 neg edge counter		√	√	
0x2270	Encoder error				√
0x2271	Clear Multi-Turn				√

OD	Name	STF**-EC	STF**-ECX-H
0x2036	Move Homeoffset		√
0x2040	Qcontrolword		√
0x2041	Qstatusword		√
0x2615	StepInputs Counts	√	

2 EtherCAT communication specification

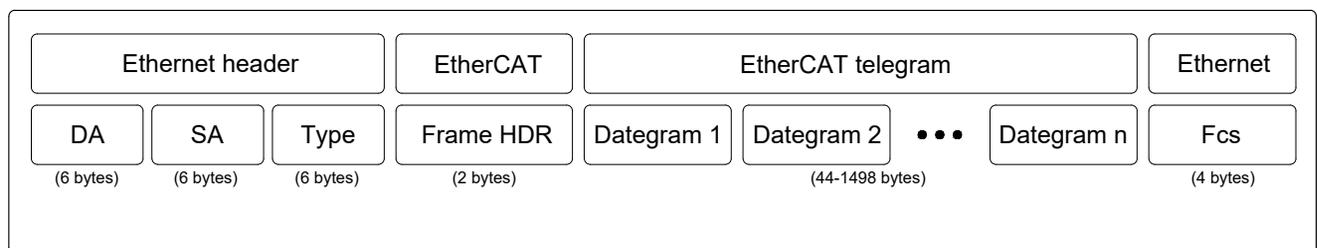
2.1 Introduction to EtherCAT

EtherCAT (Ethernet for Control Automation Technology) is a real-time Industrial Ethernet technology originally developed by Beckhoff Automation. The EtherCAT protocol which is disclosed in the IEC standard IEC61158 is suitable for hard and soft real-time requirements in automation technology, in test and measurement and many other applications.

The main focus during the development of EtherCAT was on short cycle times ($\leq 100 \mu\text{s}$), low jitter for accurate synchronization ($\leq 1 \mu\text{s}$) and low hardware costs.

2.2 EtherCAT protocol

EtherCAT embeds its payload in a standard Ethernet frame. The frame is identified with the Identifier (0x88A4) in the EtherType field. Since the EtherCAT protocol is optimized for short cyclic process data, the use of protocol stacks, such as TCP/IP or UDP/IP, can be eliminated.



To ensure Ethernet IT communication between the nodes, TCP/IP connections can optionally be tunneled through a mailbox channel without impacting real-time data transfer. During startup, the master device configures and maps the process data on the slave devices. Different amounts of data can be exchanged with each slave, from one bit to a few bytes, or even up to kilobytes of data.

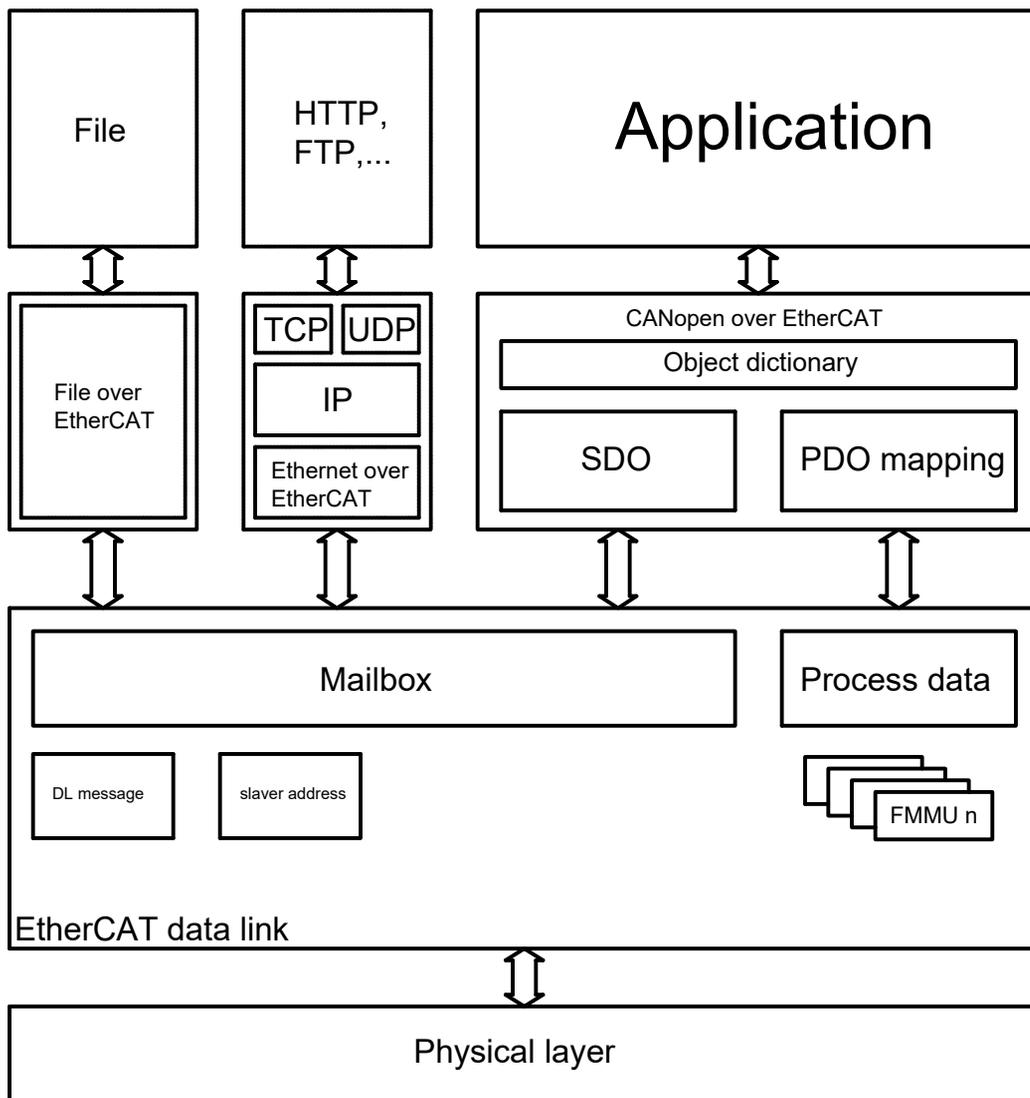
The EtherCAT frame contains one or more datagrams. The datagram header indicates what type of access the master device would like to execute:

-Read, write, read-write

Access to a specific slave device through direct addressing, or access to multiple slave devices through logical addressing (implicit addressing)

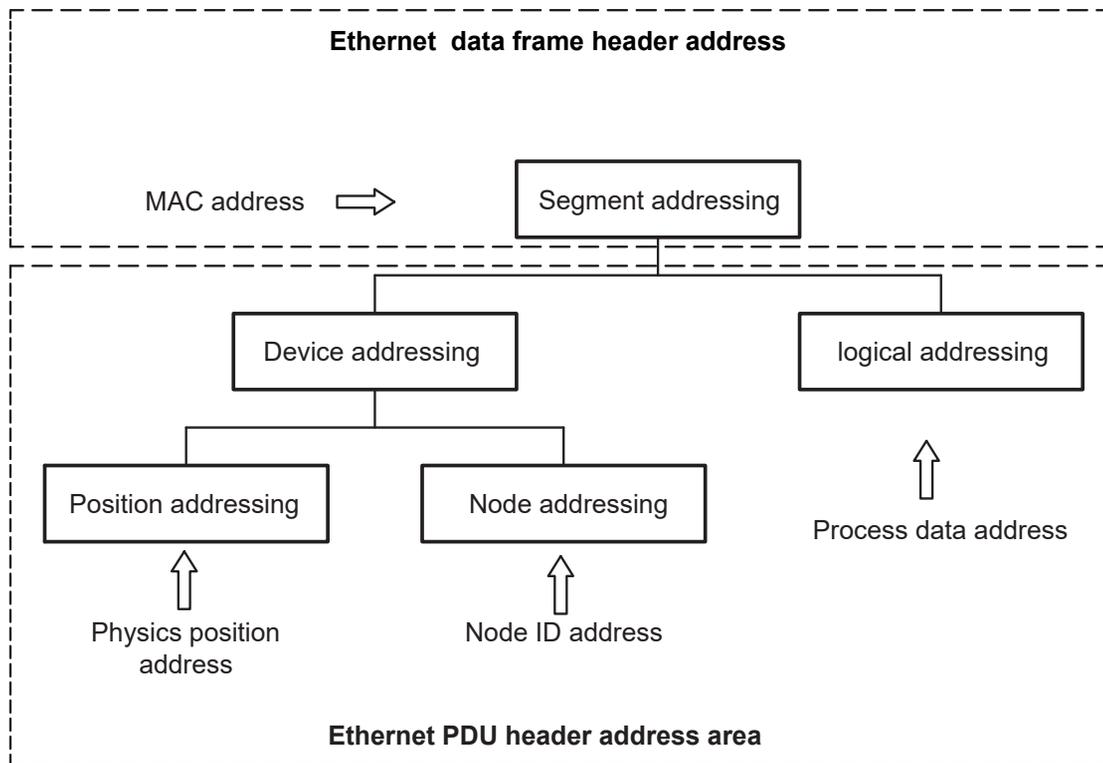
2.3 CANopen over EtherCAT

With the CoE protocol, EtherCAT provides the same communication mechanisms as in CANopen®-Standard EN 50325-4: Object Dictionary, PDO Mapping (Process Data Objects) and SDO (Service Data Objects) – even the network management is similar. This makes it possible to implement EtherCAT with minimal effort in devices that were previously outfitted with CANopen®, and large portions of the CANopen® Firmware are even reusable. Optionally, the legacy 8-byte PDO limitation can be waived, and it's also possible to use the enhanced bandwidth of EtherCAT to support the upload of the entire Object Dictionary. The device profiles, such as the drive profile CiA 402, can also be reused for EtherCAT.



2.4 EtherCAT addressing

EtherCAT communication is that the master read and write the data from the internal flash of EtherCAT slave. There has two ways for addressing to control the internal ESC register. EtherCAT addressing is as follow.



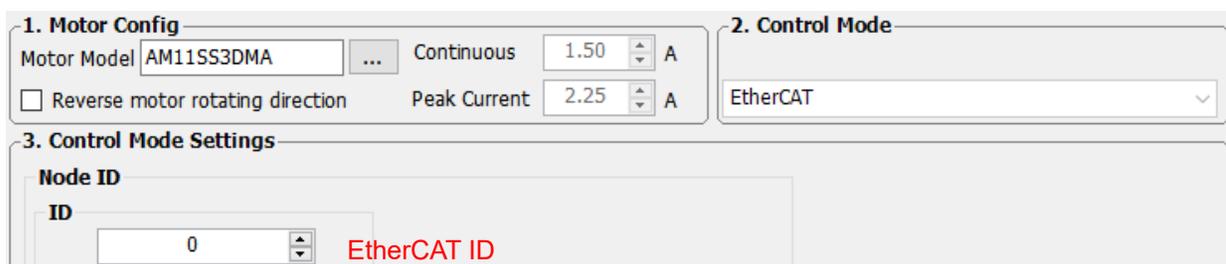
Hereby we describe about the Node addressing. Node addressing is that the slave address is nothing to do with the physics position of the topology.

There has two ways for addressing:

- -The master configure the EtherCAT ID to the slave during the data link startup phase.
- - EtherCAT ID upload from EEPROM of slaver during the data link startup phase.

The EtherCAT ID of MOONS' drive is zero in default, it means the master should assign address to the drive for EtherCAT communication when first power up. If you assign ID to the EtherCAT alias address from the software or switch of the drive except zero, the master can upload the ID from EtherCAT alias address of EEPROM with the drive.

Assign EtherCAT ID by software in the picture below:



Please reference the hardware manual of drives for details about EtherCAT ID setting.

2.5 EtherCAT slaver information

For each EtherCAT Slave a device description, the so called EtherCAT Slave Information(ESI) has to be delivered. This is done in form of an XML file (eXtensible Markup Language). It describes EtherCAT specific as well as application specific features of the slave.

The ESI file is used by an EtherCAT configuration tool to generate the EtherCAT Network Information (ENI).

There is always one unique ESI file for a device. Revision changes on the device's hardware and/or software may have to be reflected in the ESI of this device(usually by the revision Number).

The XML file can be found from our website: <https://www.moonsindustries.com/>.

2.6 Distributed clock

Distributed clock can make all the EtherCAT slave synchronize with a same reference clock. The slave that supports the distributed clock is called the DC slave. MOONS' Stepper and StepSERVO drive have three method for EtherCAT communication;

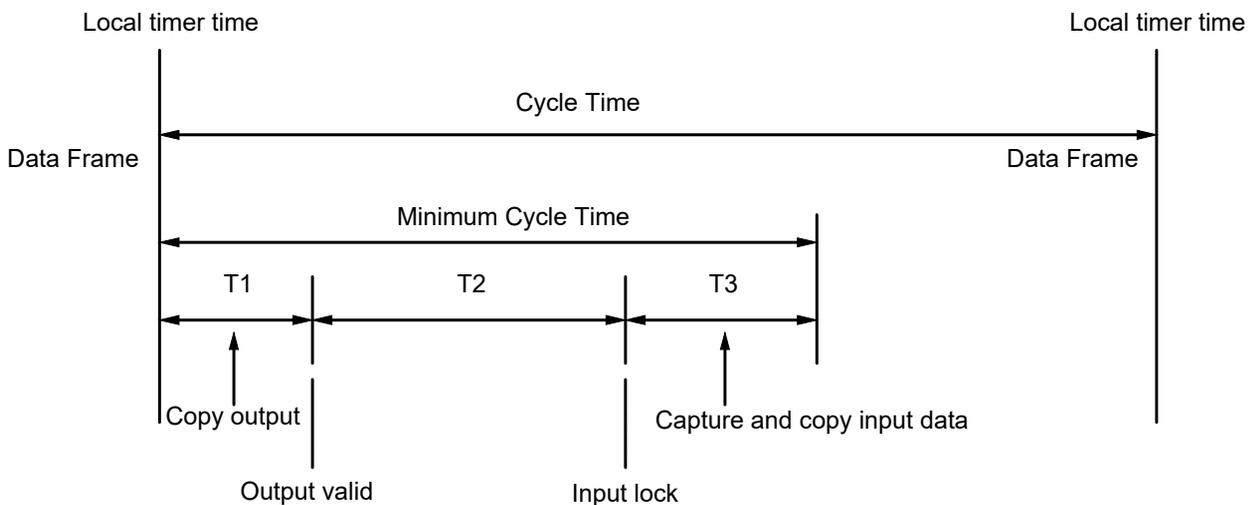
-Free Run

-SM synchron

-DC synchron

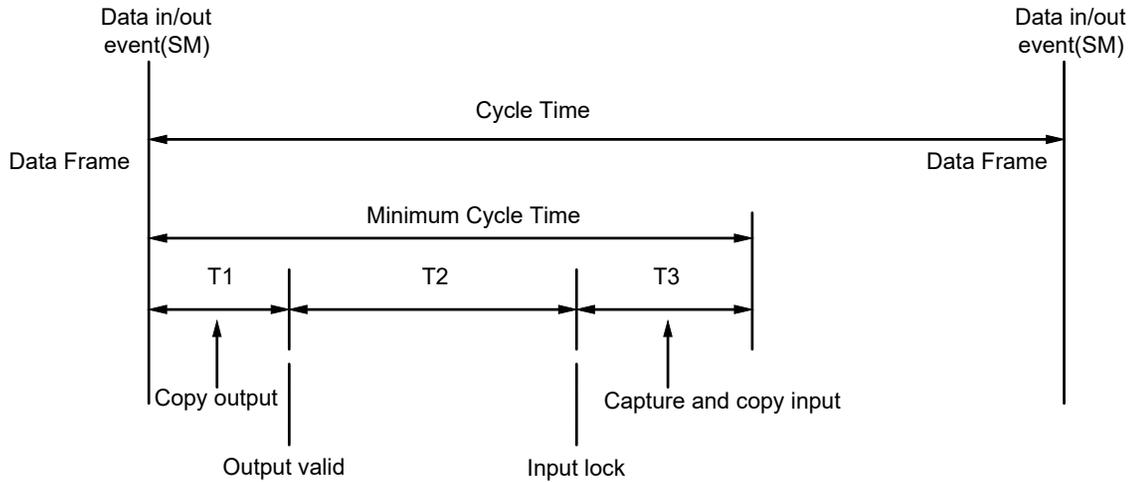
Free Run

With this mode, the data cycle time based on the local timer time. T1 and T2 is that the MPU copy the data from frame, then set output valid and caculate time.T3 is hardware delay.



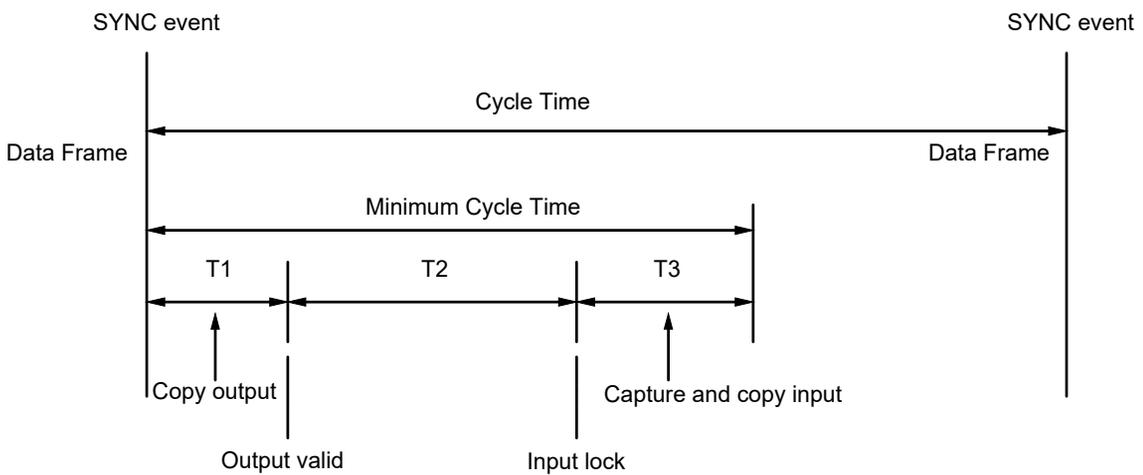
SM synchron

Synchronized with data in/out event, the local timer is trigger by the data in/out event.

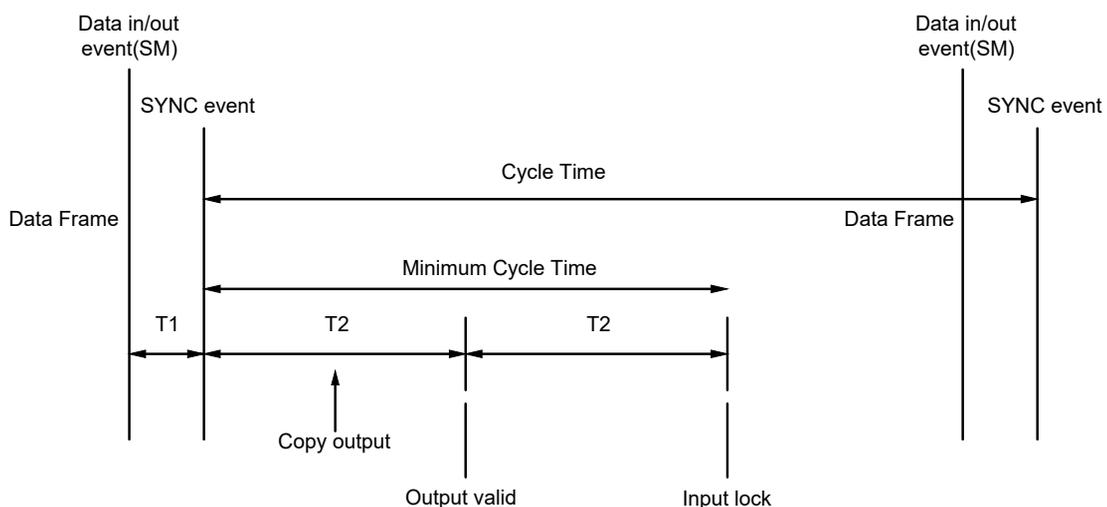


DC synchron

Synchronized with SYNC event, the EtherCAT master should transmit the data frame before the SYNC trigger. Then the EtherCAT master should synchronzie with the same clock.

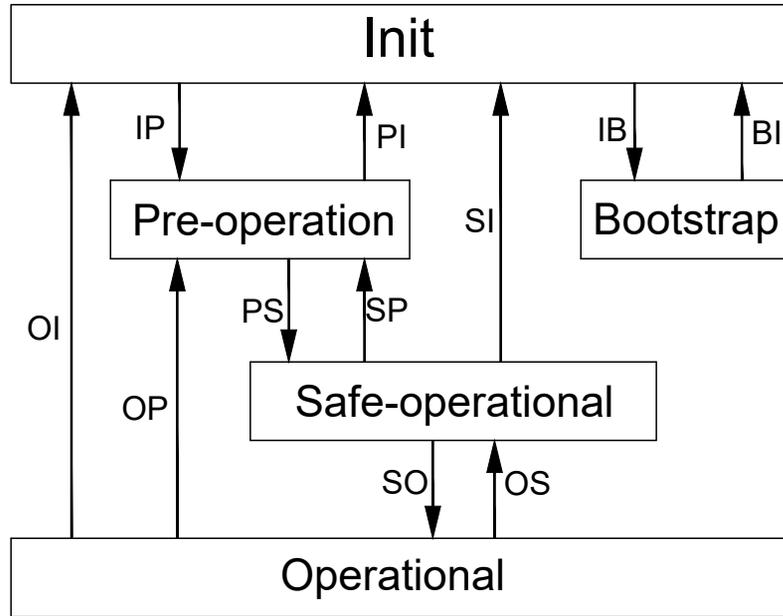


To improve synchronization performance of slave communication, the master can copy the output message of receiving process frame when the data frame out/in event is trigger.



2.7 EtherCAT state machine(ESM)

ESM (EtherCAT state machine) is used to coordinate the master and slave when in start up or working . As shown below, It indicate the transition diagram of EtherCAT state.

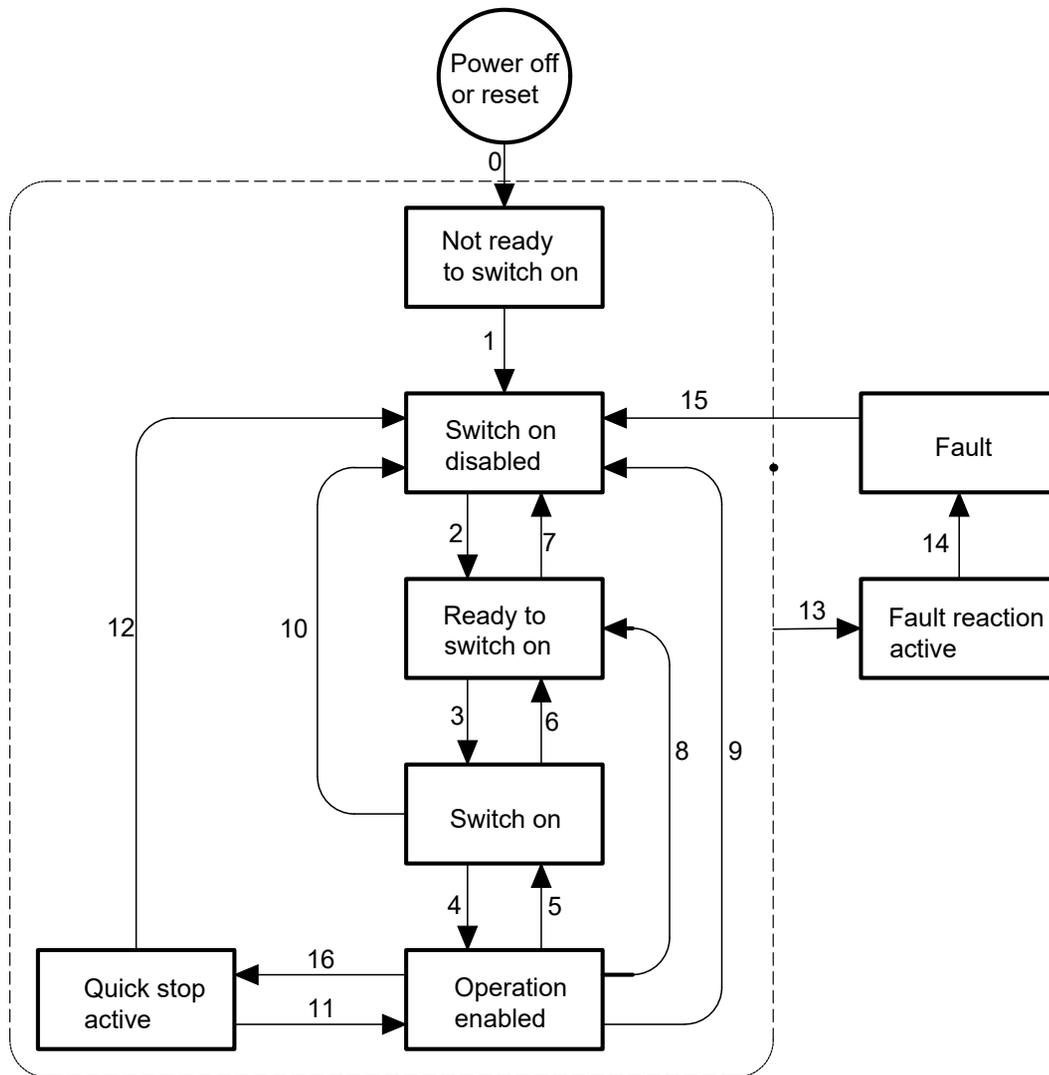


State transition	Description
IP	Start Mailbox Communication
PI	Stop mailbox communication
PS	Start input update
SP	Stop input update
SO	Start output update
OS	Stop output update
OP	Stop output update, stop input update
SI	Stop input update, stop mailbox communication
OI	Stop output update, stop input update, stop mailbox communication
IB	Start bootstrap mode
BI	Restart device

3 Motion control

3.1 Control the power drive system

MOONS' drive follows the CANopen protocol in EtherCAT communication(CANopen over EtherCAT) at application layer. So the PDS FSA control system is also suitable for EtherCAT application.



The state coding in FSA

Statusword(6041h)	PDS FSA state
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Switch on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

Transition	Event(s)	Action(s)
0	Automatic transition after power-on or reset application	Drive device self-test and/or self initialization shall be performed.
1	Automatic transition	Communication shall be activated.
2	Shut down command from control device or local signal	None
3	Switch on command received from control device or local signal	The high-level power shall be switched on, if possible.
4	Enable operation command received from control device or local signal	The drive function shall be enabled and all internal set-points cleared.
5	Disable operation command received from control device or local signal	The drive function shall be disabled.
6	Shut down command received from control device or local signal	The high-level power shall be switched off, if possible.
7	Quick stop or disable voltage command from control device or local signal	None
8	Shut down command from control device or local signal	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
9	Disable voltage command from control device or local signal	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
10	Disable voltage or quick stop command from control device or local signal	The high-level power shall be switched off, if possible.
11	Quick stop command from control device or local signal	The quick stop function shall be started.
12	Automatic transition when the quick stop function is completed and quick stop option code is 1, 2, 3 or 4, or disable voltage command received from control device (depends on the quick stop option code)	The drive function shall be disabled, and the high-level power shall be switched off, if possible.
13	Fault signal	The configured fault reaction function shall be executed.
14	Automatic transition	The drive function shall be disabled; the high-level power shall be switched off, if possible.
15	Fault reset command from control device or local signal	A reset of the fault condition is carried out, if no fault exists currently on the drive device; after leaving the fault state, the fault reset bit in the controlword shall be cleared by the control device.
16	Enable operation command from control device, if the quick stop option code is 5, 6, 7, or 8	The drive function shall be enabled.

The command codes with object at 6040h.

Command	Bits of the controlword					Transitions
	Bit7	Bit3	Bit2	Bit1	Bit0	
Shutdown	0	x	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3+4
Quick stop	0	x	x	0	x	7,9,10,12
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset	↑	x	x	x	x	15

3.2 Mode of operation

The following operation modes for MOONS' Stepper and StepSERVO are recommended:

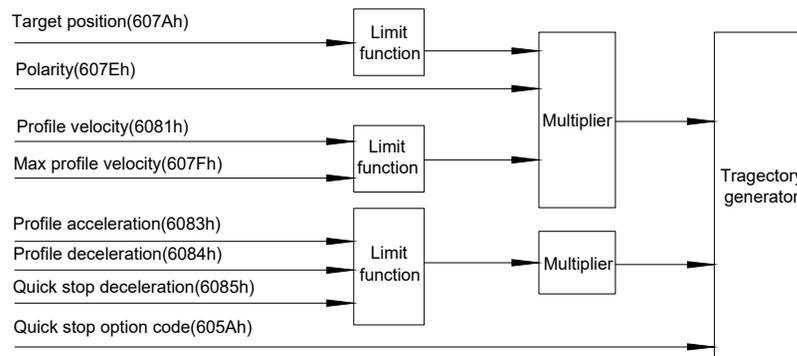
Mode of operation	Code(6060)
Profile position mode	1
Profile velocity mode	3
Profile Torque mode	4
Homing mode	6
Cynclis synchronous position mode	8
Cynclis synchronous velocity mode	9
Q mode(manufacturer specific mode)	-1

0x6060h object is the register for change control mode. when the mode of operation has been change, the object 0x6061 will be update too.

3.3 Profile position mode

3.3.1 General information

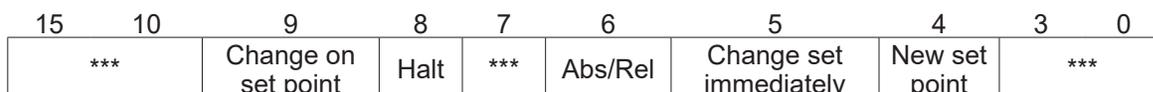
Profile position mode is a point to point operating mode using set points which consist of velocity, acceleration, deceleration, and target position. Once all these parameters have been set, the drive buffers the commands and begins executing the set point. When using a set of set points method, a new set point can be sent to the drive while a previously sent set point is still executing.



3.3.2 Main controlling object

Index	Name	Type	Access	Mapping
0x6040	Controlword	UINT16	WO	YES
0x6041	Statusword	UINT16	RO	YES
0x6060	Modes of operation	INT8	WO	YES
0x6061	Modes of operation display	INT8	RO	YES
0x607A	Target position	INT32	RW	YES
0x6081	Profile velocity	UINT32	RW	YES
0x6083	Profile acceleration	UINT32	RW	YES
0x6084	Profile deceleration	UINT32	RW	YES
0x6085	Quick stop deceleration	UINT32	RW	YES
0x605A	Quick stop code	INT16	RW	NO

Controlword of profile position mode (6040h)



***: See object description

Bit	Name	Value	Description
4	New set point	0	Toggle this bit from 0->1 to clock in a new set point
		1	
5	Change set point immediately	0	Positioning shall be completed before the next one gets started
		1	Next positioning shall be started immediately
6	Abs/Rel	0	Target position shall be an absolute value
		1	Target position shall be a relative value
8	Halt	0	positioning shall be executed or continued
		1	Axis shall be stopped
9	Change of set point	0	The previous set-point will be completed and the motor will come to rest before a new set point is processed
		1	The motor will continue at the speed commanded by the previous set point until it has reached the position commanded by the previous set point, then transition to the speed of the new set point

Statusword of profile position mode (6041h).



***: See object description

Bit	Name	Value	Description
10	Target reached	0	Halt (bit 8 in controlword) = 0: Target position not reached
			Halt (bit 8 in controlword) = 1: Axis decelerates
		1	Halt (bit 8 in controlword) = 0: Target position reached
			Halt (bit 8 in controlword) = 1: Velocity of axis is 0
12	Set point ACK	0	Previous set-point already processed, waiting for new set-point
		1	Previous set-point still in process, set-point overwriting shall be accepted
13	Following error	0	No following error
		1	Following error

3.3.3 Functional description

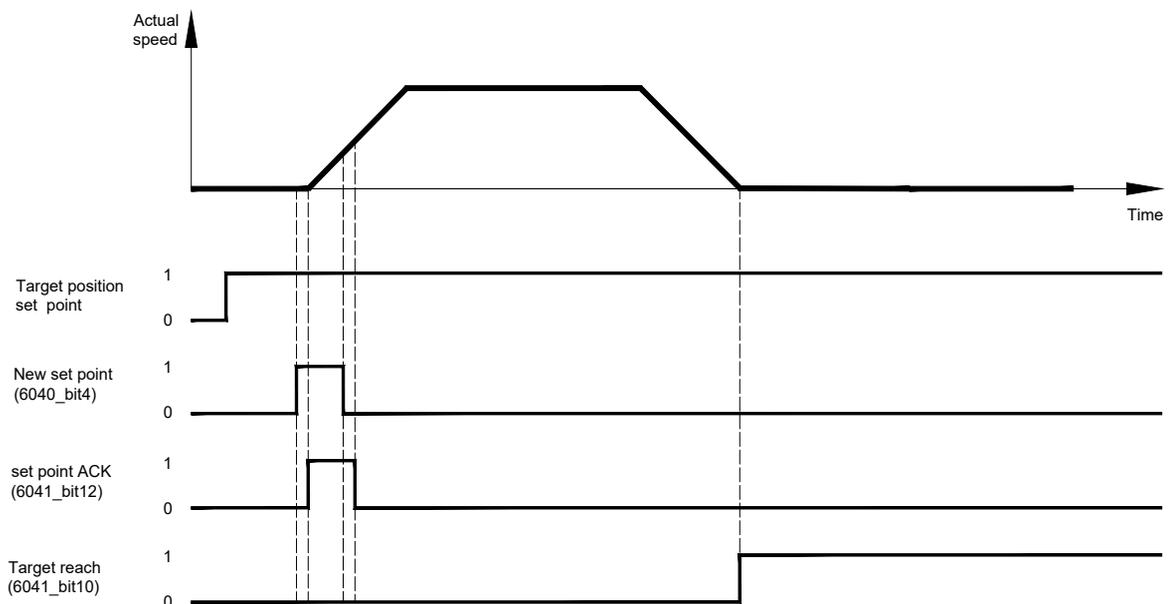
General

The setting of set-points is controlled by the timing of the new set-point bit and the change set immediately bit in the controlword as well as the set-point acknowledge bit in the statusword.

If the change set immediately bit of the controlword is set to 1, a single set-point is expected by the drive device. If the change set immediately bit of the controlword is set to 0, a set of set-points is expected by the drive device.

Set point

After a set-point is applied to the drive device, the control device signals that the set-point is valid by a rising edge of the new set-point bit in the controlword. The drive device sets the set-point acknowledge bit in the statusword to 1, and afterwards, the drive device signals with the set-point acknowledge bit set to 0 its ability to accept new set-points.



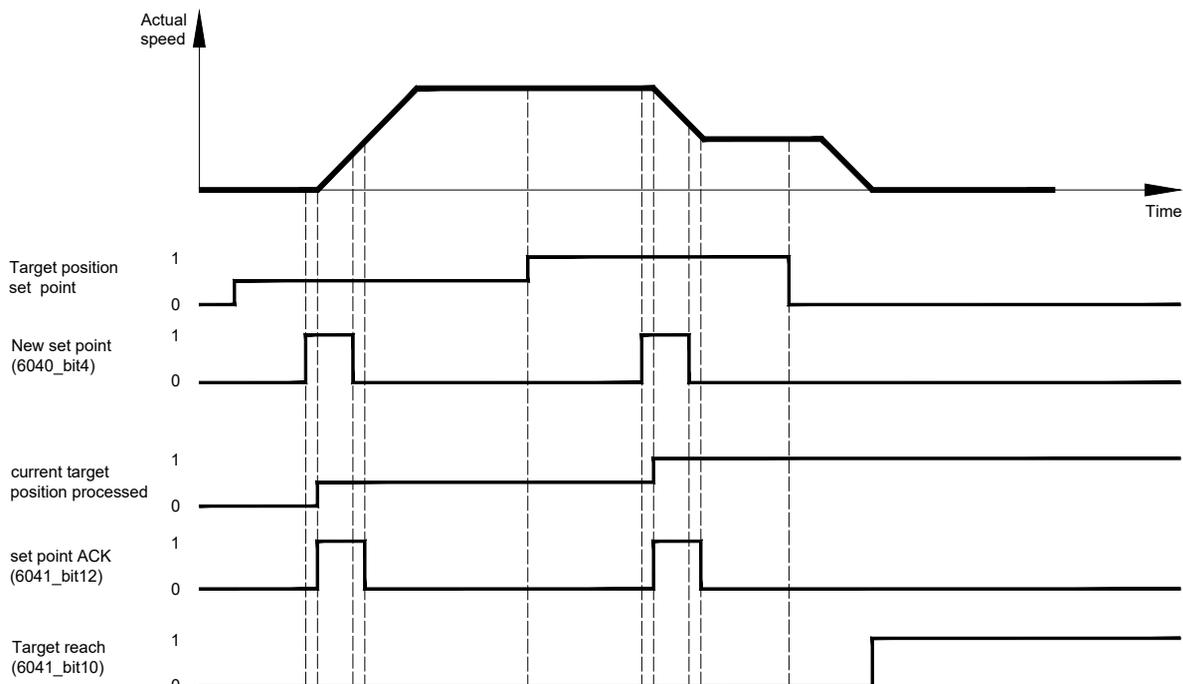
The data of controlling object:

	Event	Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on + enable operation	0x6040=15(0Fh)
Set mode of operation	Profile position mode	0x6060=1(01h)
Set motion parameters	Distance	0x607A=100000(0186A0h)
	Velocity	0x6081=20000(4E20h)
	Acceleration	0x6083=50000(C350h)
	Deceleration	0x6084=50000(C350h)
Set point absolute	New set point	0x6040=31(1Fh)
	Clear new set point	0x6040=15(0Fh)
Set point relative	New set point	0x6040=95(5Fh)
	Clear new set point	0x6040=79(4Fh)

If one set-point is still in progress and a new one is validated, two methods of handling are supported: single set-point (change set immediately bit of controlword is 1) and set of set points (change set immediately bit of controlword is 0).

Single set-point

When a set-point is in progress and a new set-point is validated by the new set-point (bit 4) in the controlword, the new set-point shall be processed immediately.

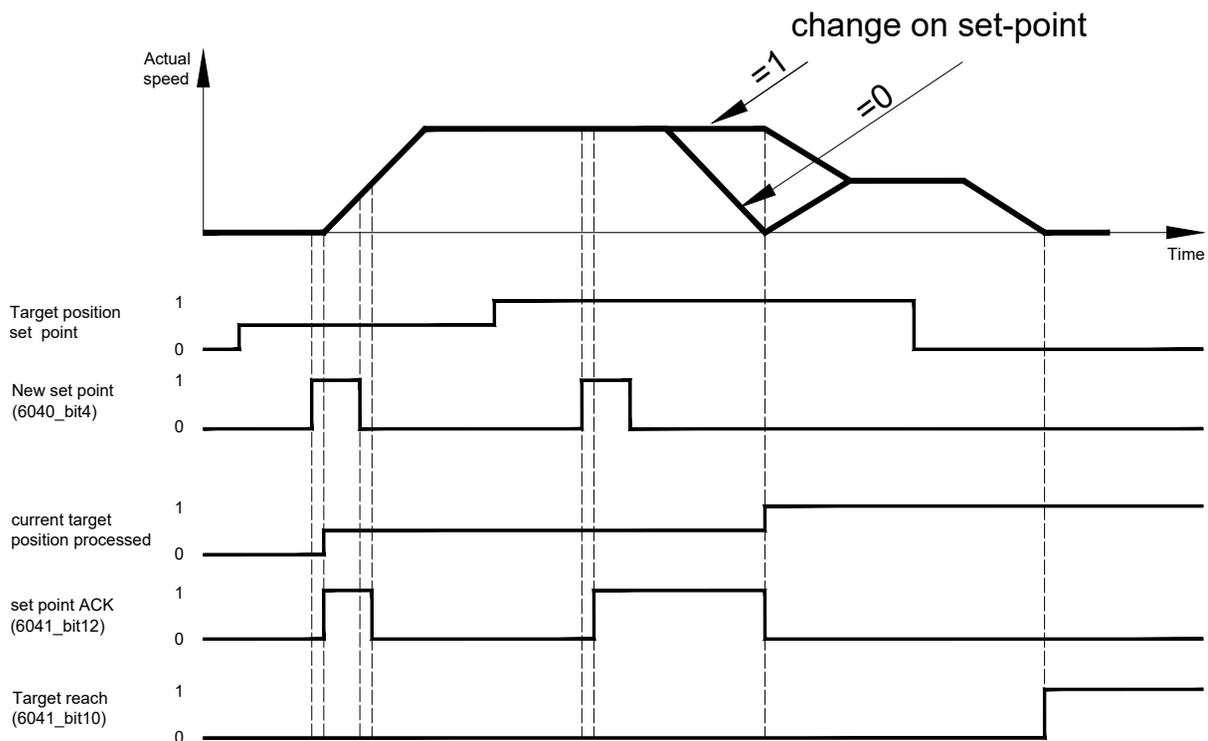


The data of controlling object:

	Event	Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on + enable operation	0x6040=15(0Fh)
Set mode of operation	Profile position mode	0x6060=1(01h)
Set motion parameters	Acceleration	0x6083=50000(C350h)
	Deceleration	0x6084=50000(C350h)
Single set point	First part of velocity	0x6081=30000(7530h)
	First part of distance	0x607A=200000(030D40h)
	New set point	0x6040=639(27Fh)
	Clear new set point	0x6040=623(26Fh)
	Second part of velocity	0x6081=20000(4E20h)
	Second part of distance	0x607A=100000(0186A0h)
	New set point	0x6040=639(27Fh)
	Clear new set point	0x6040=623(26Fh)

Set of set-points

When a set-point is in progress and a new set-point is validated by the new set-point (bit 4) in the controlword, the new set-point shall be processed only after the previous has been reached.



The data of controlling object:

Event	Set parameter	Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on + enable operation	0x6040=15(0Fh)
Set mode of operation	Profile position mode	0x6060=1(01h)
Set motion parameters	Acceleration	0x6083=50000(C350h)
	Deceleration	0x6084=50000(C350h))
Set of set-points with change on set-point=0	First part of velocity	0x6081=30000(7530h)
	First part of distance	0x607A=400000(061A80h)
	New set point	0x6040=95(5Fh)
	Clear new set point	0x6040=79(4Fh)
	Second part of velocity	0x6081=20000(4E20h)
	Second part of distance	0x607A=300000(7530h)
	New set point	0x6040=95(5Fh)
	Clear new set point	0x6040=79(4Fh)
Set of set-points with change on set-point=1	First part of velocity	0x6081=30000(7530h)
	First part of distance	0x607A=400000(061A80h)
	New set point	0x6040=607(25Fh)
	Clear new set point	0x6040=591(24Fh)
	Second part of velocity	0x6081=20000(4E20h)
	Second part of distance	0x607A=300000(0493E0h)
	New set point	0x6040=607(25Fh)
	Clear new set point	0x6040=591(24Fh)

NOTE: MOONS' EtherCAT drive can be set up with two set-points, if the bit 12 of statusword is 1, then the buffer is full and another set-point will be ignored.

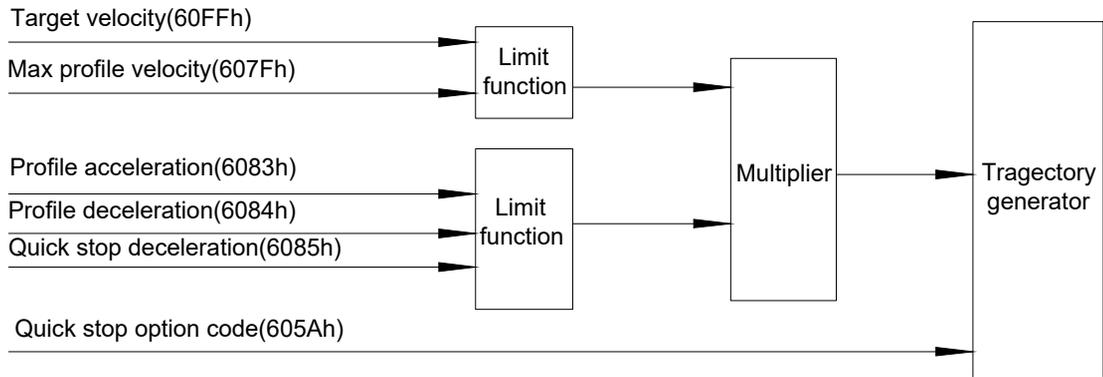
Stop the motor with halt (0x6040_bit8)

If a drive is processing a set-point, the halt bit (bit 8 of the controlword) can be used to stop the motor and keep it in position control. After releasing the halt bit the processing of the actual set-point is continued.

3.4 Profile velocity mode

3.4.1 General information

Profile Velocity Mode is a relatively simple operating mode. Once the velocity, acceleration, and deceleration are set, the drive will either command the motor to accelerate to the running velocity according to the acceleration parameter, or to halt movement according to the deceleration parameter.



3.4.2 Main controlling object

Index	Name	Type	Access	Mapping
0x6040	Controlword	UINT16	WO	YES
0x6041	Statusword	UINT16	RO	YES
0x6060	Modes of operation	INT8	WO	YES
0x6061	Modes of operation display	INT8	RO	YES
0x60FF	Target velocity	UINT32	RW	YES
0x6083	Profile acceleration	UINT32	RW	YES
0x6084	Profile deceleration	UINT32	RW	YES

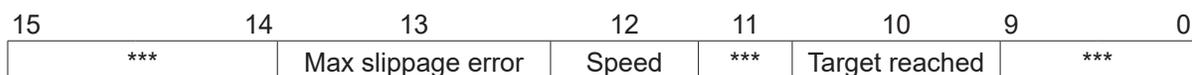
Controlword of profile velocity mode



***: See object description

Bit	Name	Value	Description
8	Halt	0	The motion shall be executed or continued
		1	Axis shall be stopped according to the halt option code (0x605D)

Statusword of profile velocity mode



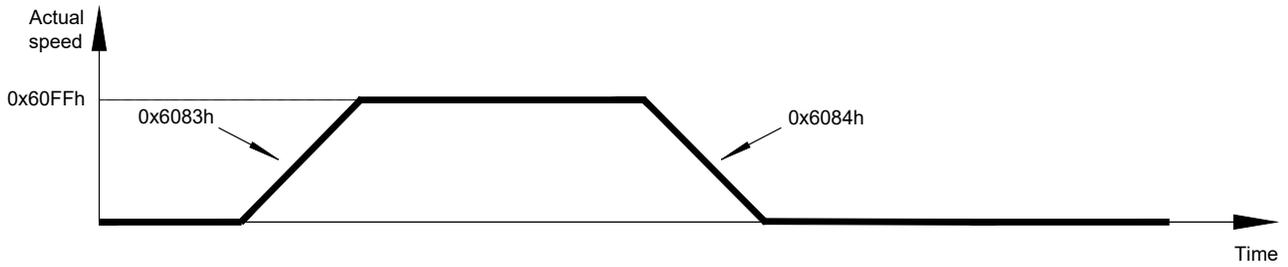
***: See object description

Bit	Name	Value	Description
10	Target reached	0	Halt (bit 8 in controlword) = 0: Target not reached Halt (bit 8 in controlword) = 1: Axis decelerates
		1	Halt (bit 8 in controlword) = 0: Target reached Halt (bit 8 in controlword) = 1: Velocity of axis is 0
12	Speed	0	Speed is not equal 0
		1	Speed is equal 0
13	Max slippage error	0	Maximum slippage not reached
		1	Maximum slippage reached

3.4.3 Functional description

Profile velocity mode is according to the specified velocity, acceleration and deceleration value for moving. And to stopped with halt (6040_bit8) control.

1. Target velocity (60FFh)
2. Profile acceleration (6083h)
3. Profile deceleration (6084h)

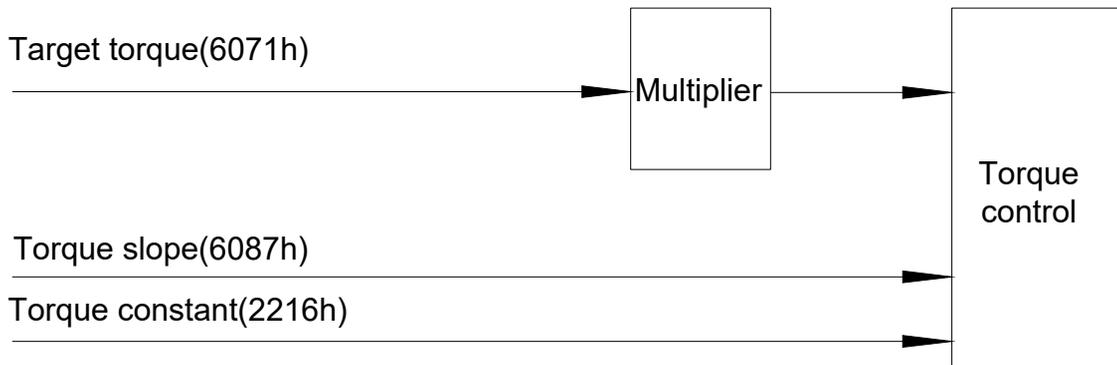


Event		Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on + enable operation +halt	0x6040=271(010Fh)
Set mode of operation	Profile velocity mode	0x6060=3(3h)
Set motion parameter	Target velocity	0x60FF=20000(4E20h)
	Acceleration	0x6083=50000(C350h)
	Deceleration	0x6084=50000(C350h)
Velocity mode	Start	0x6040=15(Fh)
	Stop	0x6040=271(010Fh)

3.5 Profile torque mode (StepSERVO only)

3.5.1 General information

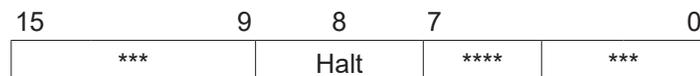
Profile Torque mode is a servo-control torque operating mode. It requires knowledge of the Torque Constant of the motor in mN/A. This information can be found in the motor print.



3.5.2 Main controlling object

Index	Name	Type	Access	Mapping
0x6040	Controlword	UINT16	WO	YES
0x6041	Statusword	UINT16	RO	YES
0x6071	Target torque	INT16	RW	NO
0x6087	Torque slope	INT8	WO	YES
0x2216	Torque constant	INT8	RO	YES

Controlword of profile torque mode



***: See object description

Bit	Name	Value	Description
8	Halt	0	The motion shall be executed or continued
		1	Axis shall be stopped according to the halt option code (0x605D)

Statusword of profile torque mode



***: See object description

Bit	Name	Value	Description
10	Target reached	0	Halt (bit 8 in controlword) = 0: Target not reached
			Halt (bit 8 in controlword) = 1: Axis decelerates
		1	Halt (bit 8 in controlword) = 0: Target reached
			Halt (bit 8 in controlword) = 1: Velocity of axis is 0

3.5.3 Functional description

To operate in profile torque mode, the following parameters must be set:

Index	Name	Description
0x2216	Torque constants	Motor parameter, found on the motor print
0x6071	Target torque	Torque to be applied to the motor
0x6087	Torque slope	Rate at which to ramp torque to new target

Parameter calculations – example

An application requires a torque of 0.353 Nm, and torque slope of 0.177 Nm/sec. we found the torque constants is 0.07Nm/A. then we write the value to the object:

Index	value	Units
0x2216	70	m•Nm/A
0x6071	353	m•Nm
0x6087	177	m•Nm/sec

Current verification – example

It is important to check that the current required of the drive is within the limits of the servo amplifier. The drive being used, for example, has a continuous rating of 7 amps, and a peak current of 14 amps, which may be held continuously for 2 seconds. This means that a current of 7 amps can be held indefinitely, and currents between 7 and 14 amps may be used in short bursts.

Using the target torque and torque constant from the example above the current draw can be checked, as shown:

$$0.353\text{Nm}/(0.07 \text{ Nm/A}) = 5.044\text{A}$$

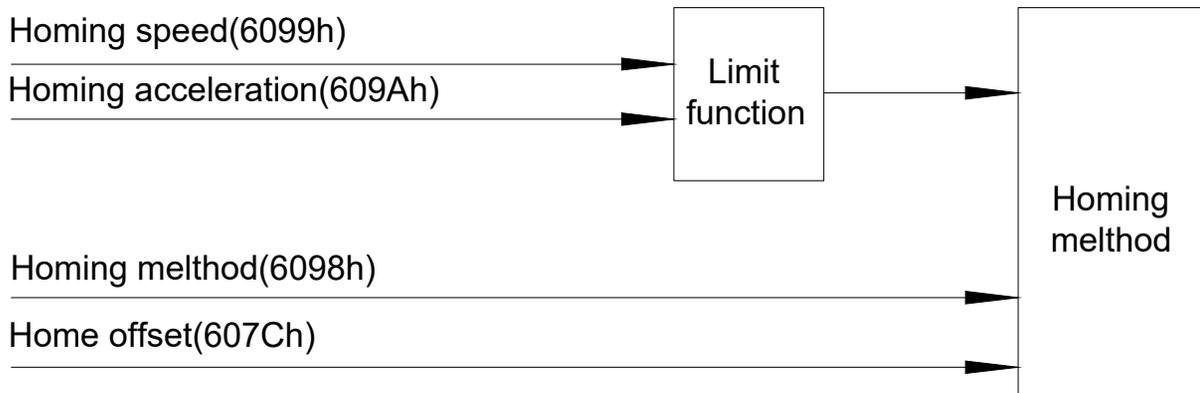
The resultant current, 5.044A, is below the 7A continuous current rating of the drive, and well below the peak current rating of 14A. It is possible for the drive to maintain a current of 7A indefinitely, and peak up to 14A for up to two seconds continuously. Values between 7A and 14A may be held proportionally long.

	Event	Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on + enable operation +halt	0x6040=271(010Fh)
Set mode of operation	Profile velocity mode	0x6060=4(04h)
Set motion parameter	Target torque	0x6071=20(14h)
	Torque slope	0x6087=500(01F4h)
	Torque constant	0x2216=100(64h)
Profile torque mode	Start	0x6040=15(0Fh)
	Stop	0x6040=271(10Fh)

3.6 Homing mode

3.6.1 General information

This clause describes the method by which a drive seeks the home position (also called, the datum, reference point or zero point). There are various methods of achieving this using limit switches at the ends of travel or a home switch (zero point switch) in mid-travel, most of the methods also use the index (zero) pulse train from an incremental encoder.



3.6.2 Main controlling object

Index	Name	Type	Access	Mapping
0x6040	Controlword	UINT16	WO	YES
0x6041	Statusword	UINT16	RO	YES
0x6060	Mode of operation	INT8	WO	YES
0x6098	Home method	INT8	RW	NO
0x6099	Homing speed	-	-	-
0x609A	Homing acceleration	INT32	RW	YES
0x2001	Home switch	INT8	RW	YES
0x607C	Homing offset	INT32	RW	YES

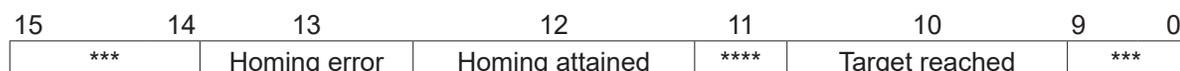
Controlword of homing mode



***: See object description

Bit	Name	Value	Description
4	Homing operation start	0	Do not start homing procedure
		1	Start or continue homing procedure
8	Halt	0	Enable bit4
		1	Stop axis according to halt option code (0x605D)

Statusword of homing mode



**: See object description

Bit13	Bit12	Bit10	definition
0	0	0	Homing procedure is in progress
0	0	1	Homing procedure is interrupted or not started
0	1	0	Homing is attained, but target is not reached
0	1	1	Homing is procedure is 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

3.6.3 Functional description

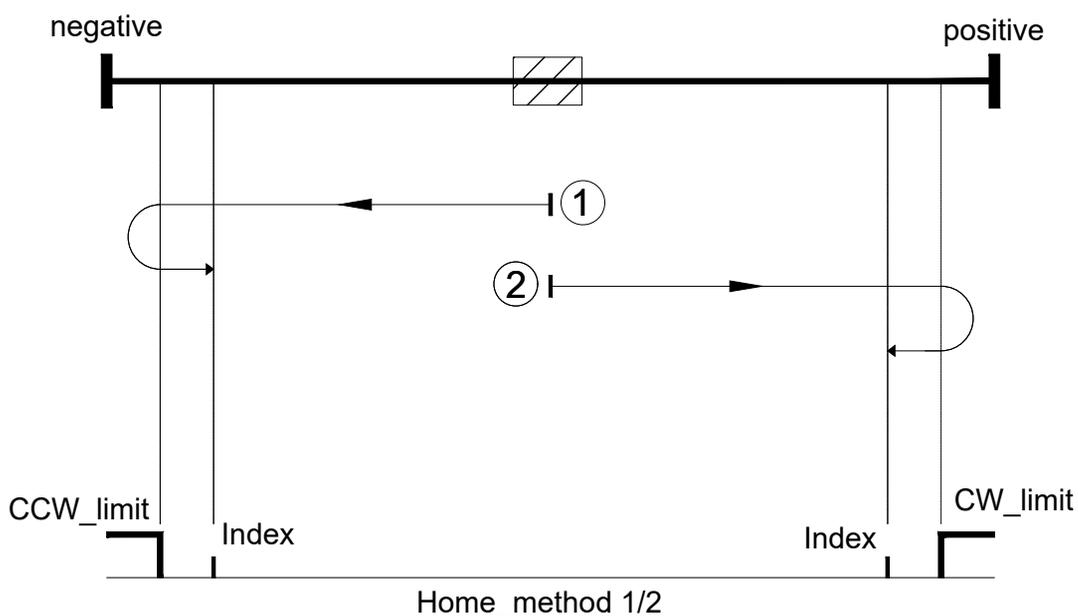
The homing modes are working on logical values of the limit and homing switches (object 60FD_n).

The data of controlling object:

Event		Set parameter
Enable motor power	Shut down	0x6040=06(06h)
	Switch on	0x6040=07(07h)
	Switch on+ enable operation	0x6040=15(0Fh)
Set mode of operation	Homing mode	0x6060=06(06h)
Set home method	Home method=13	0x6098=13(0Dh)
Set motion parameters	Homing acceleration	0x609A=200000(030D40h)
	Velocity for switch	0x6099_sub1=20000(4E20h)
	Velocity for index	0x6099_sub2=2000(07D0h)
	Homing offset	0x607C=100000(0186A0h)
	Homing switch	0x2001=5(05h)
Homing mode	Homing start	0x6040=31(1Fh)
	Homing stop	0x6040=287(011Fh)

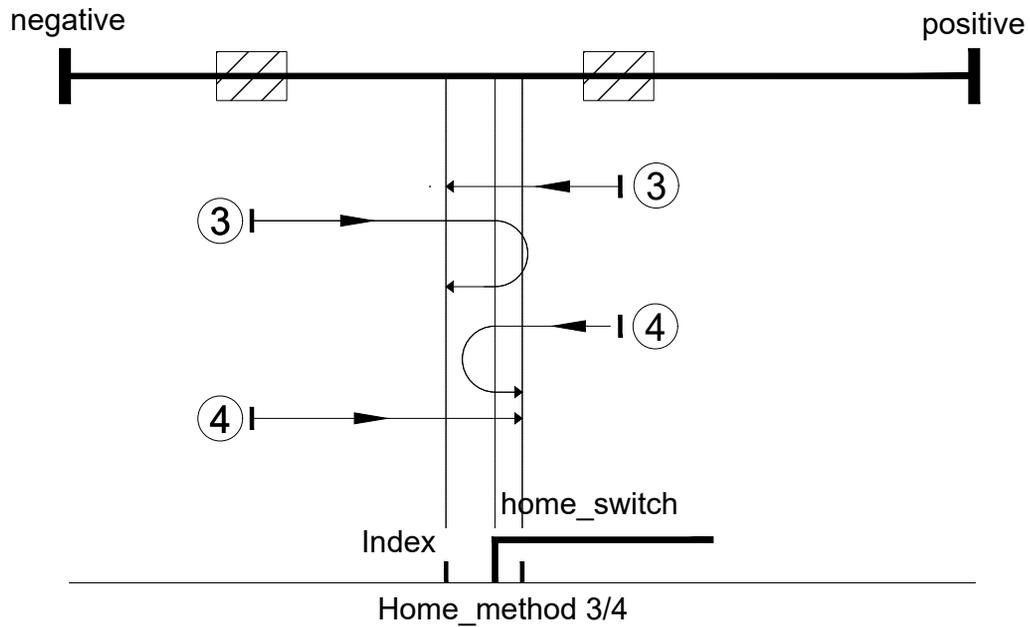
3.6.4 Method 1 and 2

The initial direction of movement shall be leftward (method 1) or rightward (method 2) if the limit switch is inactive. The position of home shall be at the first index pulse to the limit switch becomes inactive.



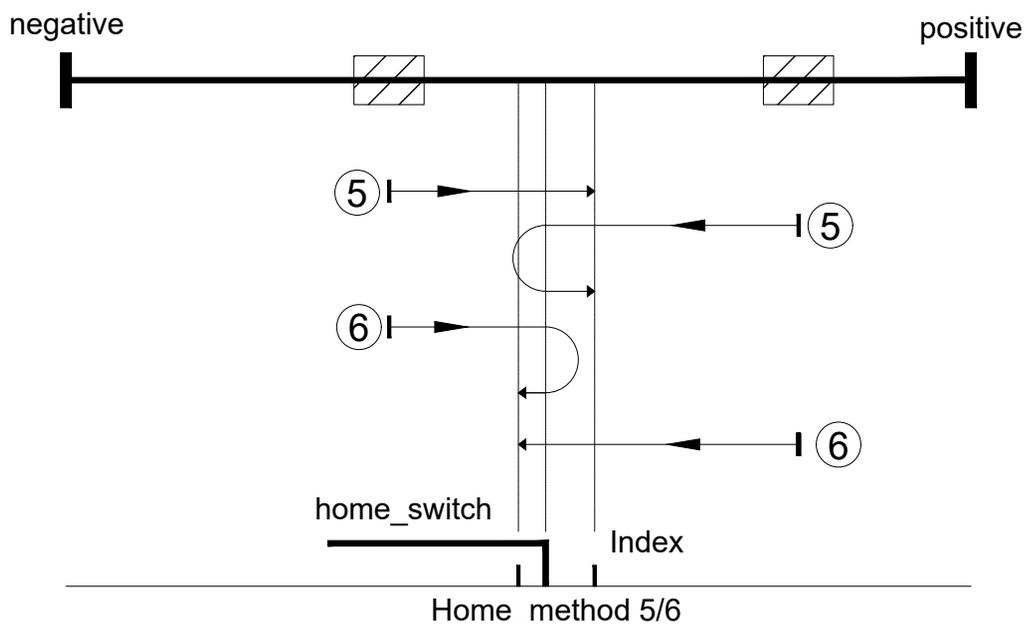
3.6.5 Method 3 and 4

The initial direction of movement shall be dependent on the state of the home switch. The home position shall be at the index pulse to either to the left or the right of the point where the home switch changes state. If the initial position is situated so that the direction of movement shall reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.



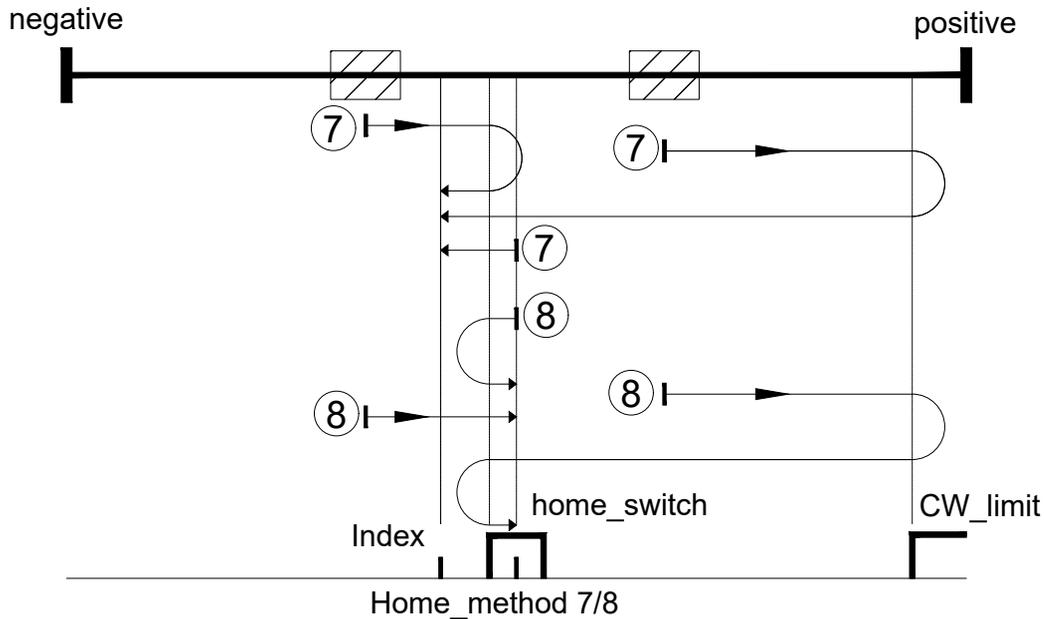
3.6.6 Method 5 and 6

The initial direction of movement shall be dependent on the state of the home switch. The home position shall be at the index pulse to either to the left or the right of the point where the home switch changes state. If the initial position is situated so that the direction of movement shall reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.



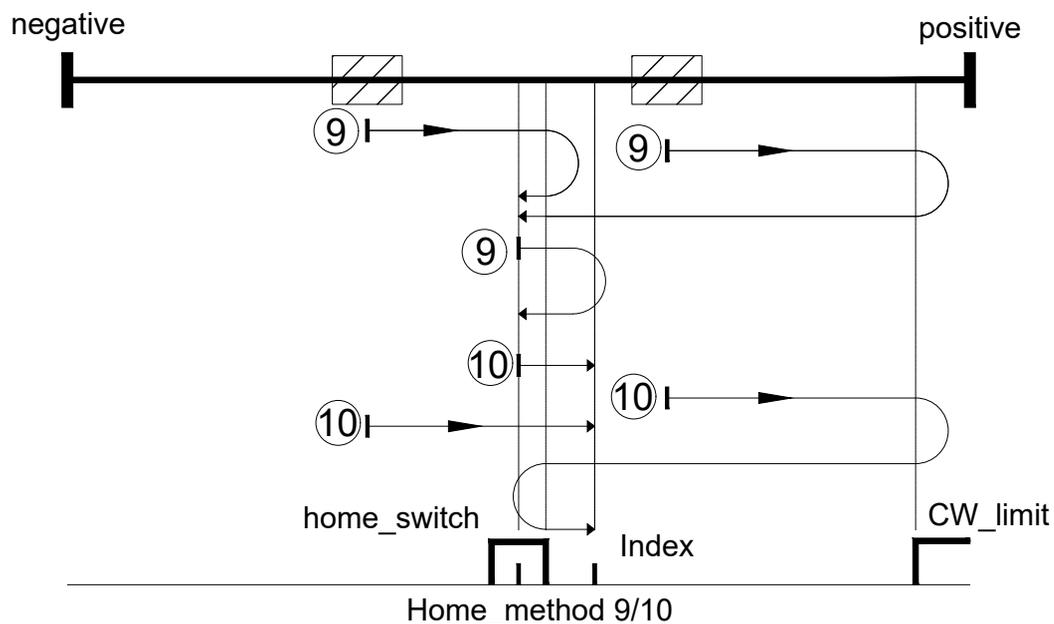
3.6.7 Method 7 and 8

The initial direction of movement shall be rightward if the positive limit switch is inactive. With the method 7, the home position shall be at the first index pulse to the left side of the home switch which the changes status is on falling edge. The home position shall be at the first index pulse to the left side of home switch which the changes status is on rising edge that moved from negative to positive on method 8 .



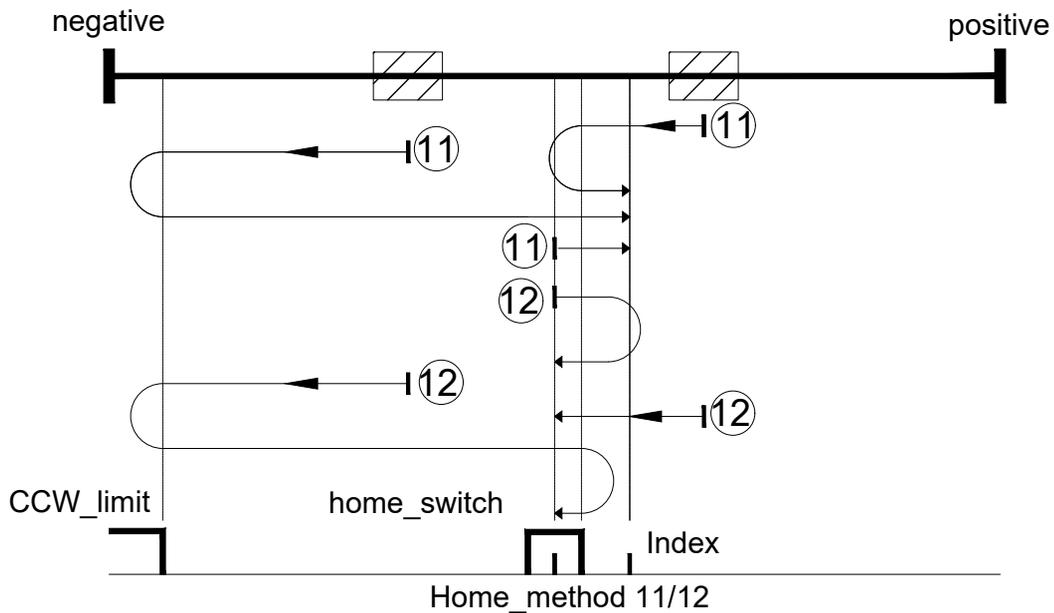
3.6.8 Method 9 and 10

The initial direction of movement shall be rightward if the positive limit switch is inactive. With the method 9, the home position shall be at the first index pulse to the right side of the home switch which the changes status is on rising edge that moved from positive to negative. The home position shall be at the first index pulse to the right side of home switch which the changes status is on falling edge with method 10.



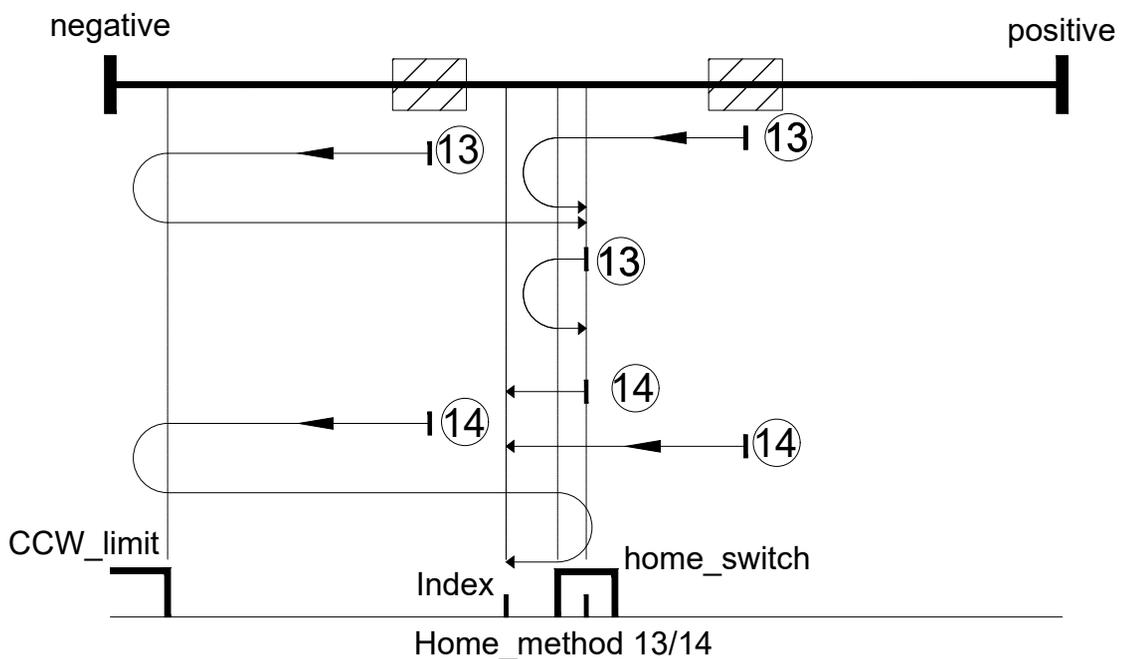
3.6.9 Method 11 and 12

The initial direction of movement shall be leftward if the negative limit switch is inactive. With the method 11, the home position shall be at the first index pulse to the right side of the home switch which the changes status is on falling edge. The home position shall be at the first index pulse on the right side of home switch which the changes status is on rising edge with method 12.



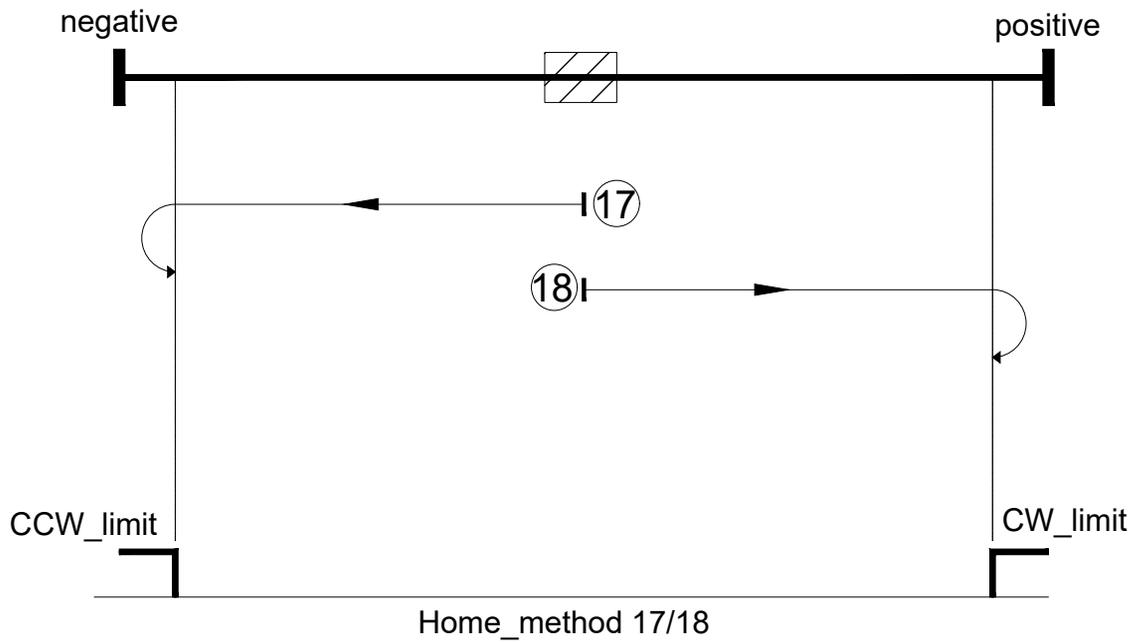
3.6.10 Method 13 and 14

The initial direction of movement shall be leftward if the negative limit switch is inactive. With the method 13, the home position shall be at the first index pulse to the left side of the home switch which the changes status is on falling edge. The home position shall be at the first index pulse to the left side of home switch which the changes status is on rising edge that moved from negative to positive on method 14.



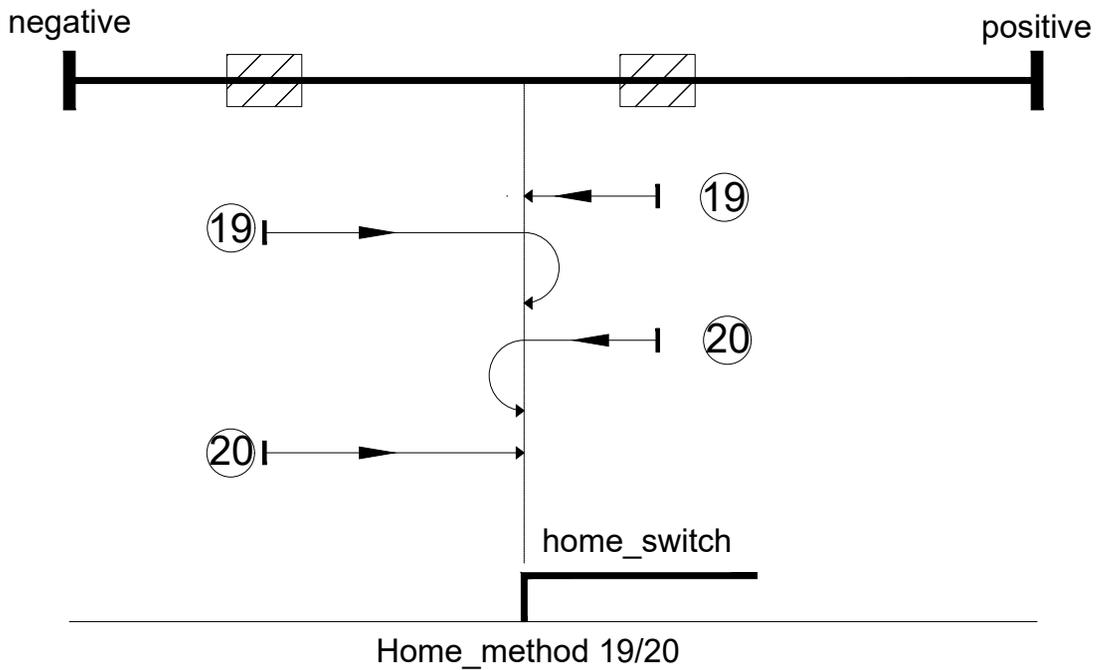
3.6.11 Method 17 and 18

The method17 and 18 are similar to methods 1 and 2 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



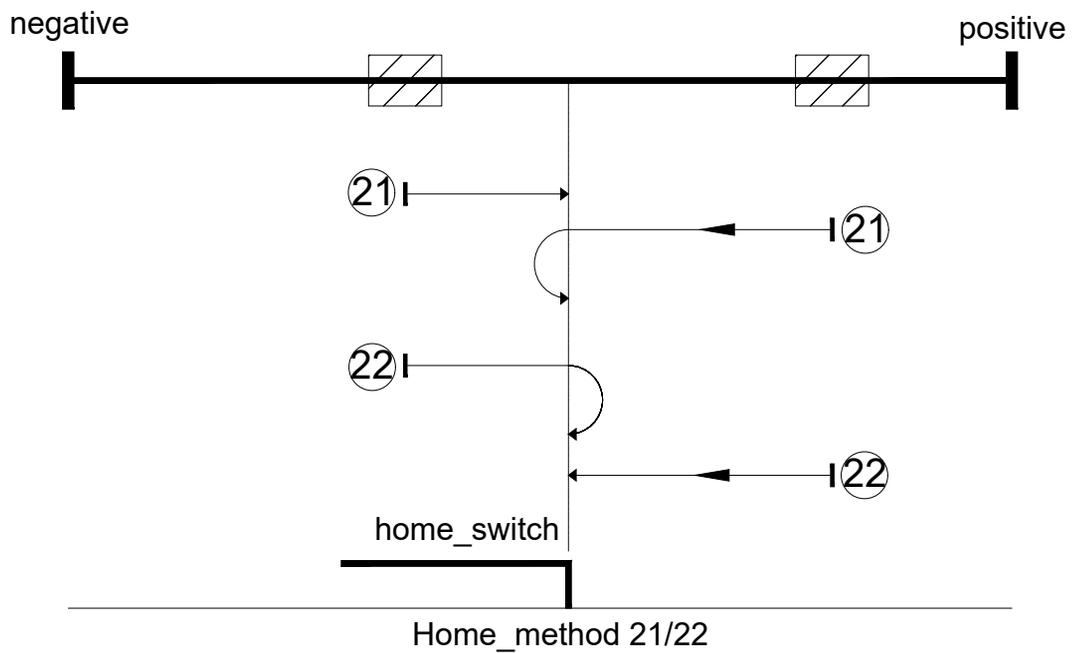
3.6.12 Method 19 and 20

The method 19 and 20 are similar to methods 3 and 4 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



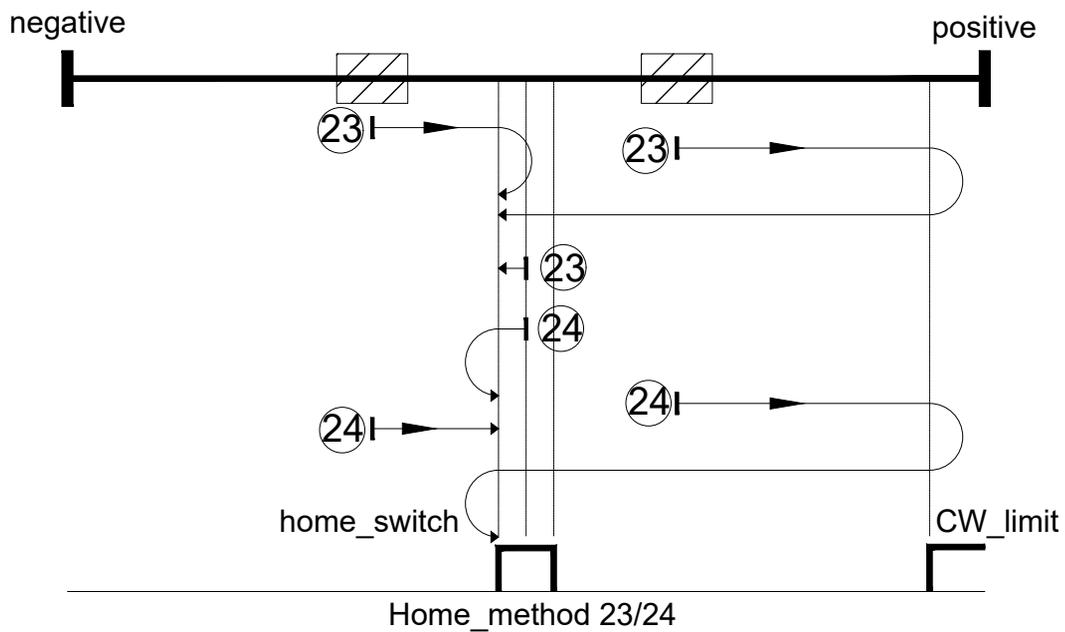
3.6.13 Method 21 and 22

The method 21 and 22 are similar to methods 5 and 6 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



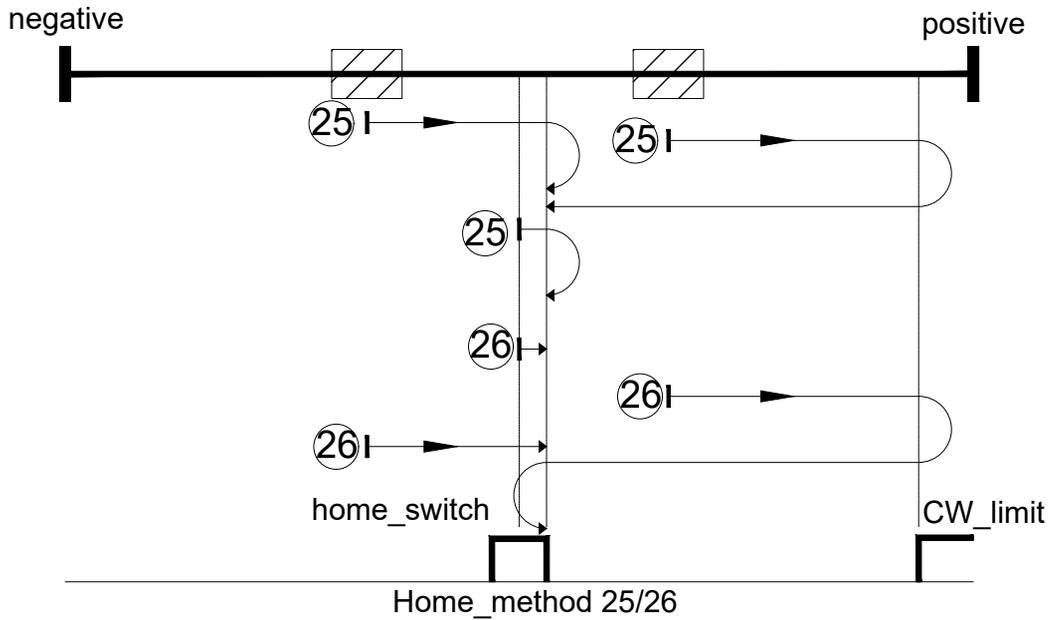
3.6.14 Method 23 and 24

The method 23 and 24 are similar to methods 7 and 8 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



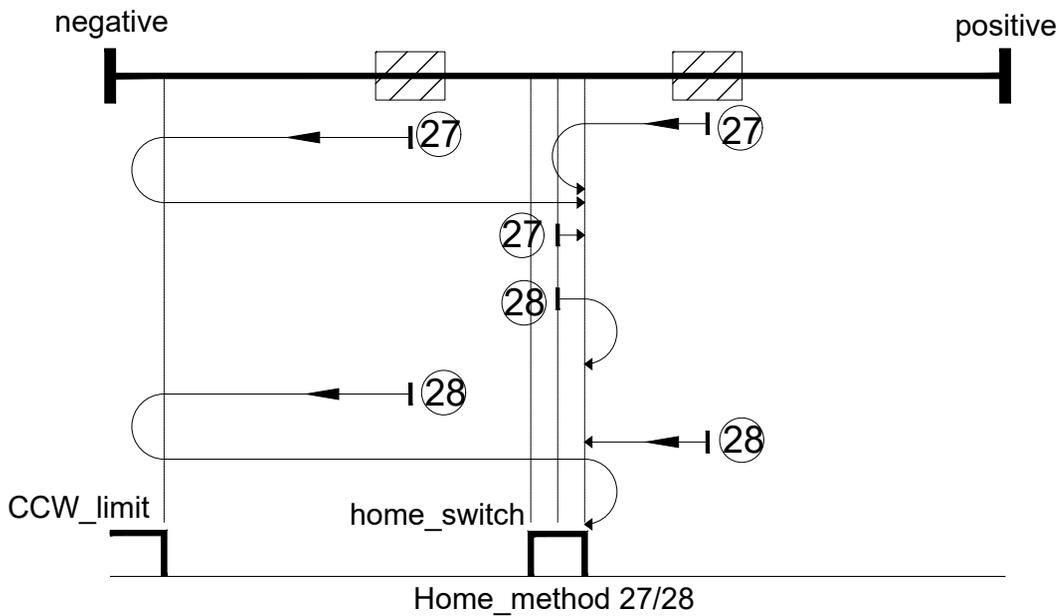
3.6.15 Method 25 and 26

The method 25 and 26 are similar to methods 9 and 10 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



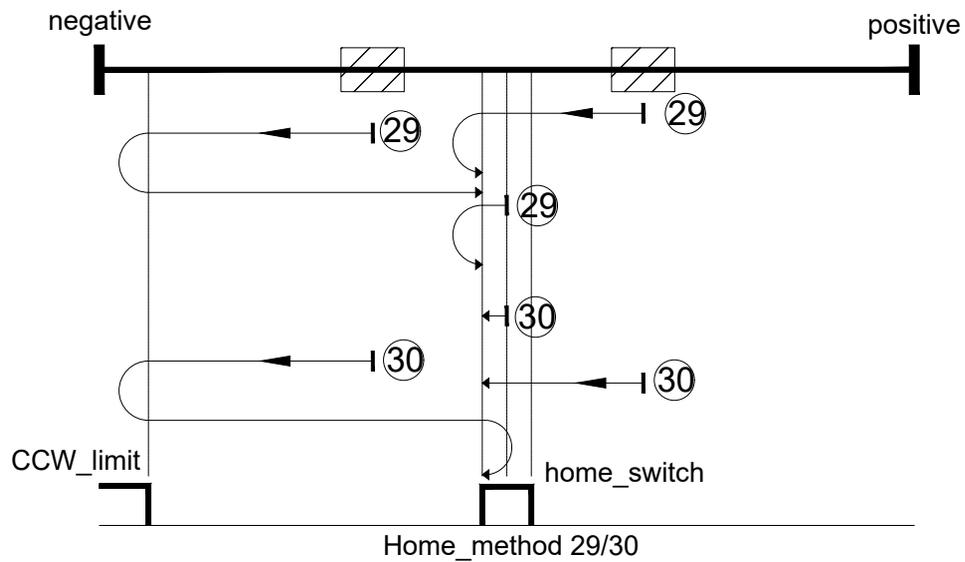
3.6.16 Method 27 and 28

The method 27 and 28 are similar to methods 11 and 12 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



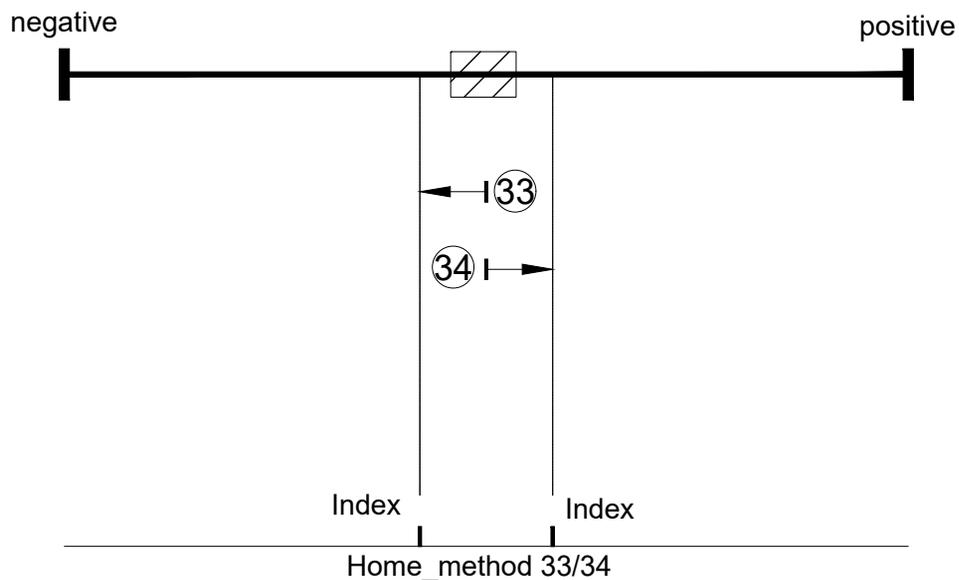
3.6.17 Method 29 and 30

The method 29 and 30 are similar to methods 13 and 14 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions.



3.6.18 Method 33 and 34

Using these methods, the direction of homing is negative or positive respectively. The home position shall be at the index pulse found in the selected direction



3.6.19 Method 35

In this method, the current position shall be taken to be the home position. This method does not require the drive device to be in operational enabled state.

3.6.20 Method 37

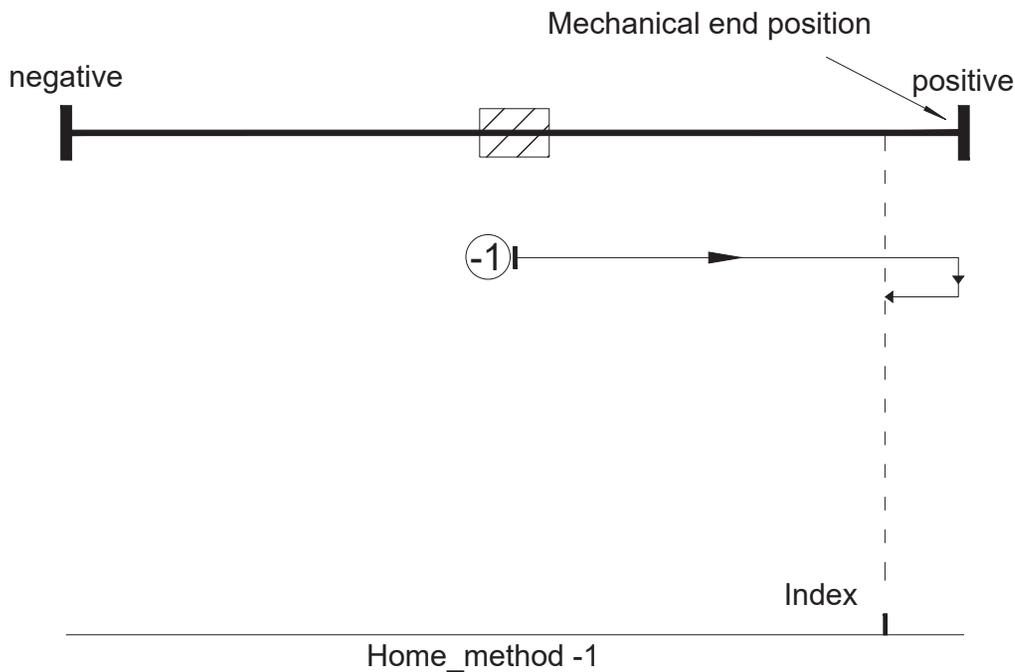
In this method, the position sensor information (converted in user-defined position units) shall be taken to be the home position. This method does not require the drive device to be in operation enabled state. At the home position (i.e. after the homing process) the position actual value (6064h) is calculated as follows:

$$\text{Position actual value (6064h)} = \text{Home offset (607C}_h\text{)}$$

In addition, we provide the hard stop homing without limit switch.

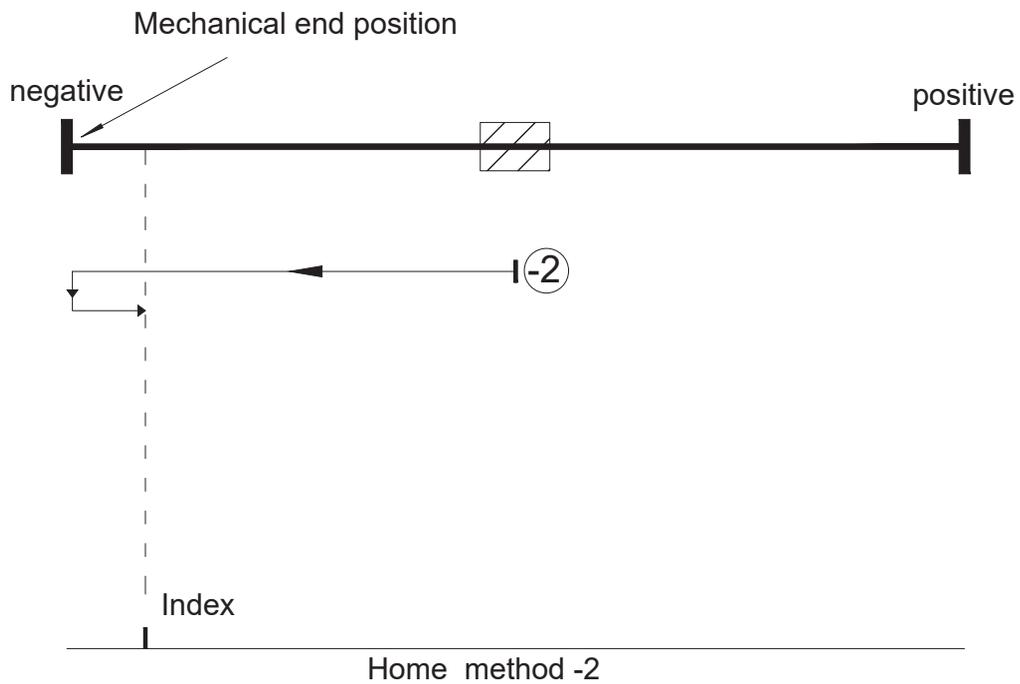
3.6.21 Method -1

In this method, the initial direction of movement shall be rightward and reach the mechanical end position. Then the motor will return to the first index pulse.



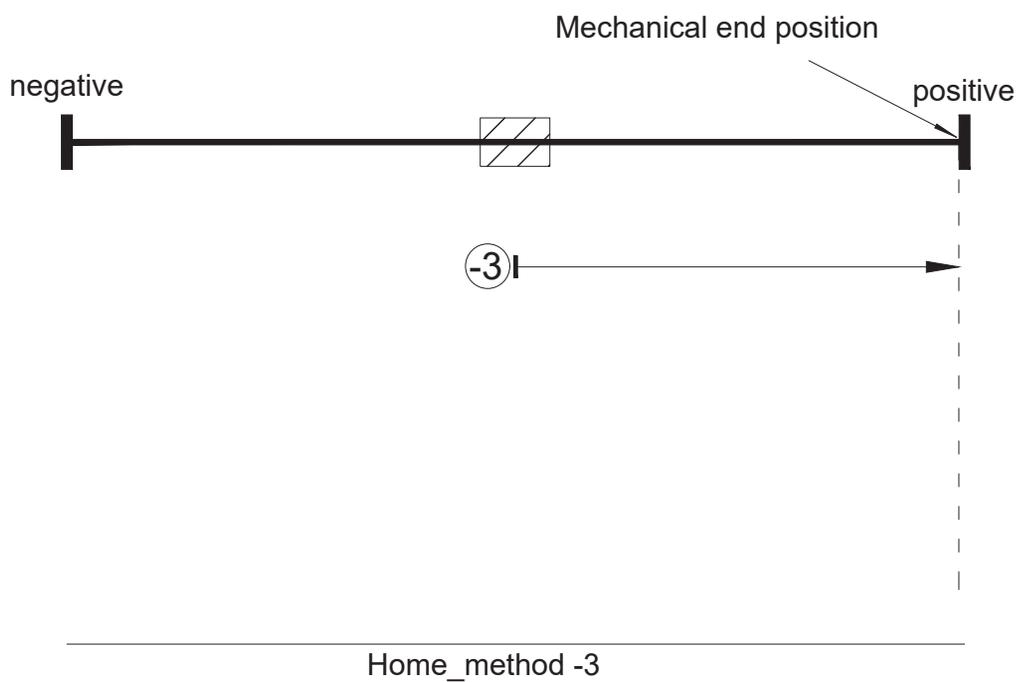
3.6.22 Method -2

In this method, the initial direction of movement shall be leftward and reach the mechanical end position. Then the motor will return to the first index pulse.



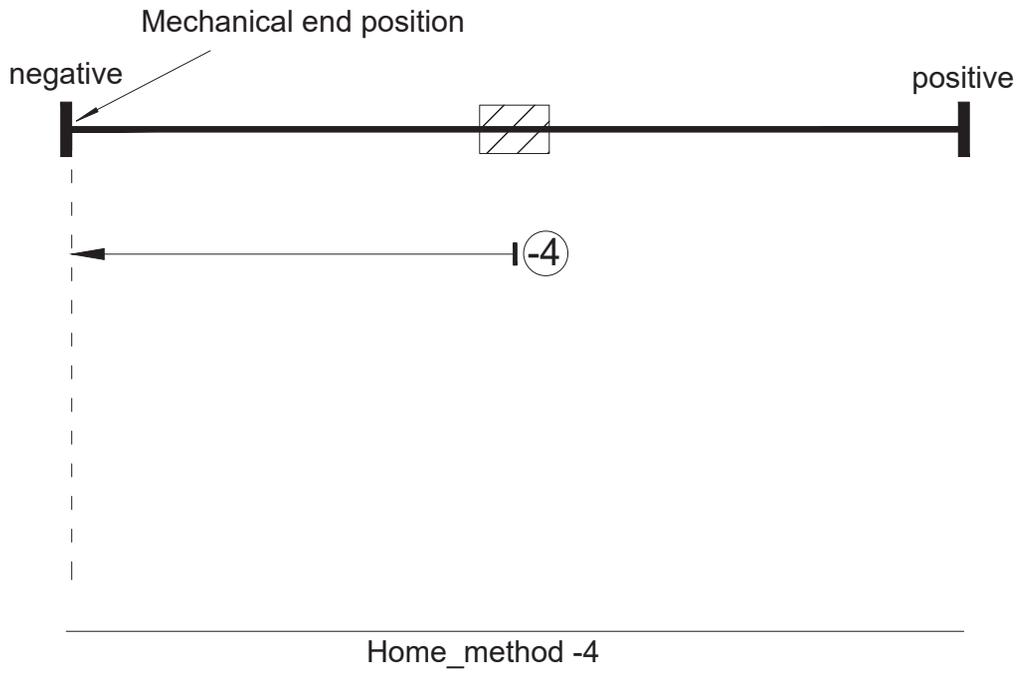
3.6.23 Method -3

In this method, the initial direction of movement shall be rightward and reach the mechanical end position.



3.6.24 Method -4

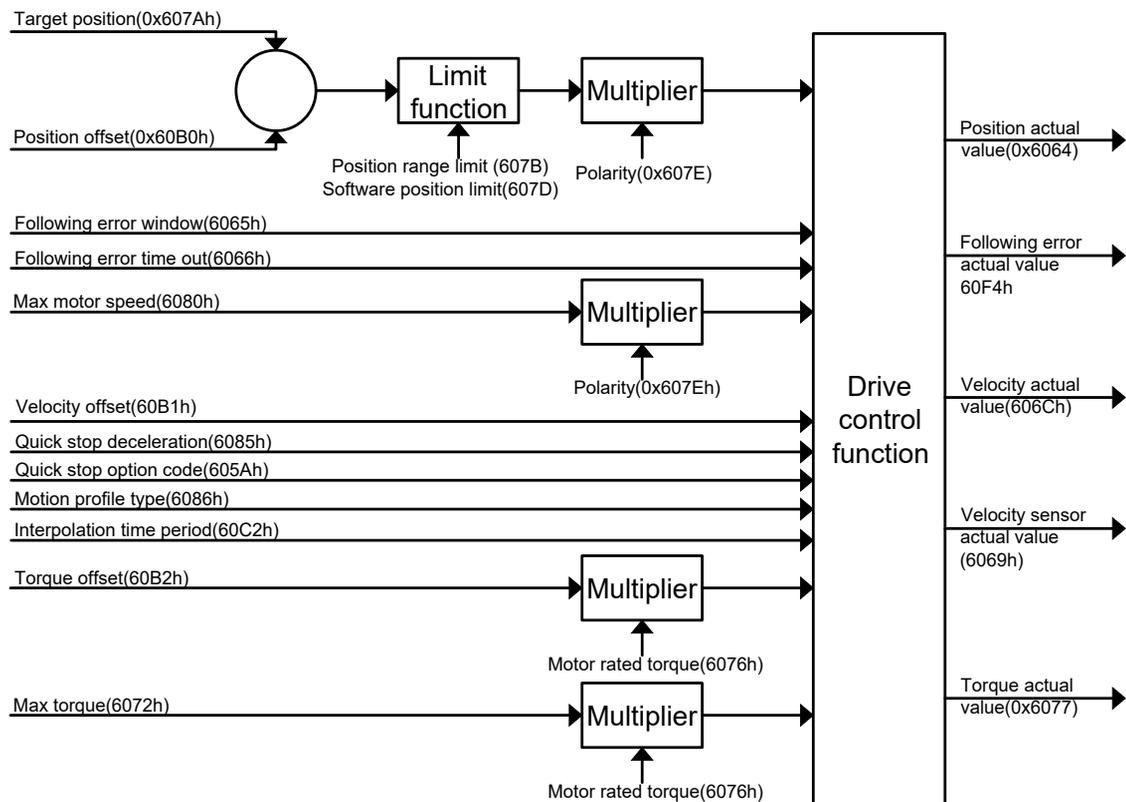
In this method, the initial direction of movement shall be leftward and reach the mechanical end position.



3.7 Cyclic synchronous position mode

3.7.1 General information

With this mode, the trajectory generator is located in the control device, not in the drive device. In cyclic synchronous manner, it provides a target position to the drive device, which performs position control, velocity control and torque control.



3.7.2 Main controlling object

Index	Name	Type	Access	Mapping
0x6040	Controlword	UINT	WO	YES
0x6041	Statusword	UINT	RO	YES
0x6060	Mode of operation	INT	WO	YES
0x607A	Target position	INT	WO	YES
0x60B0	Position offset	DINT	RW	YES
0x6085	Quick stop deceleration	UDINT	RW	YES
0x605A	Quick stop option code	INT	RW	YES
0x6064	Position actual value	DINT	RO	YES
0x60F4	Following error actual value	DINT	RO	YES
0x606C	Velocity actual value	DINT	RO	YES
0x6065	Following error window	UDINT	RW	NO

Controlword

The cyclic synchronous position mode uses no mode-specific bits of the controlword .

Statusword

15	14	13	12	11	10	9	0
***	Following error	Drive follows the command value	****	Status toggle	***		

***: See object description

Bit	Value	Definition
10	0	Reserved
	1	Reserved
12	0	Target position ignored
	1	Target position used as input to position control loop
13	0	No following error
	1	Following error

In the statusword Bit 12 is mandatory. The Bit 13 is recommended.

The Bit 10 is used in Profile position mode as "Target reached" information. In csp the new target position is given cyclically by the control device. This bit is used as Status Toggle information to indicate if the device provides updated input data. The bit shall be toggled with every update of the input process data. If object 0x60D9 is supported, the Status Toggle function can be enabled or disabled.

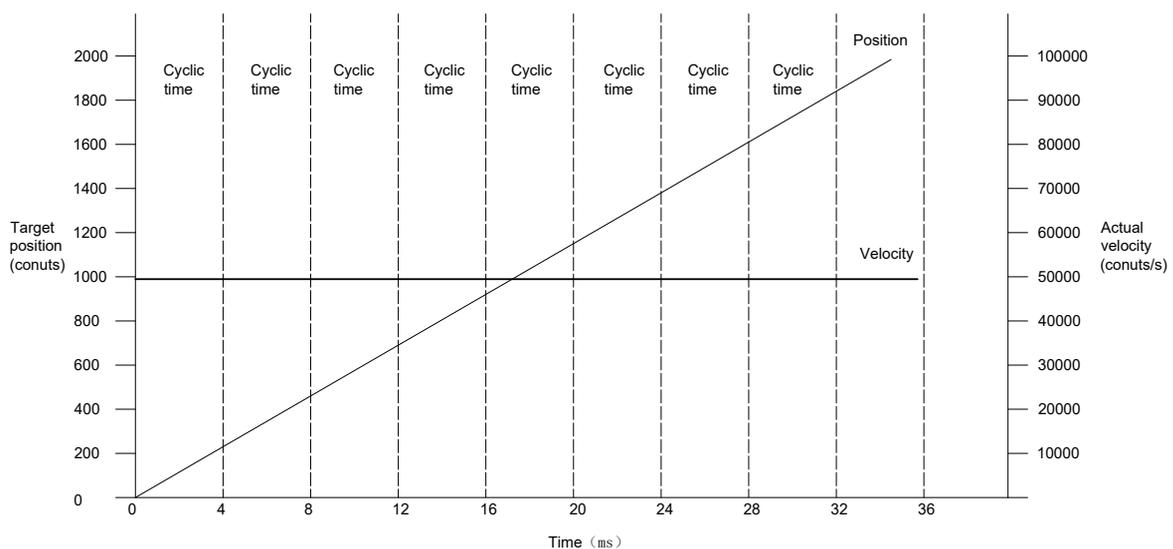
The Bit 12 drive follows the command value shall be zero if the drive does not follow the target value (position, velocity or torque) because of local reasons (internal set-point settings). E.g. if a local Input is configured to a halt function or a safety function prevents the drive in operational to follow the target set point. The control device shall evaluate the bit. The Bit 12 shall be set if the drive is in state operation enabled and follows the target and set-point values of the control device. In all other cases it shall be zero. If the bit is not supported it shall be fix set to 1 in the statusword.

3.7.3 Functional description

With this mode, the control device should provide the target position with every cyclic communication.

The velocity, acceleration, deceleration of motor is based on cyclic time and target position.

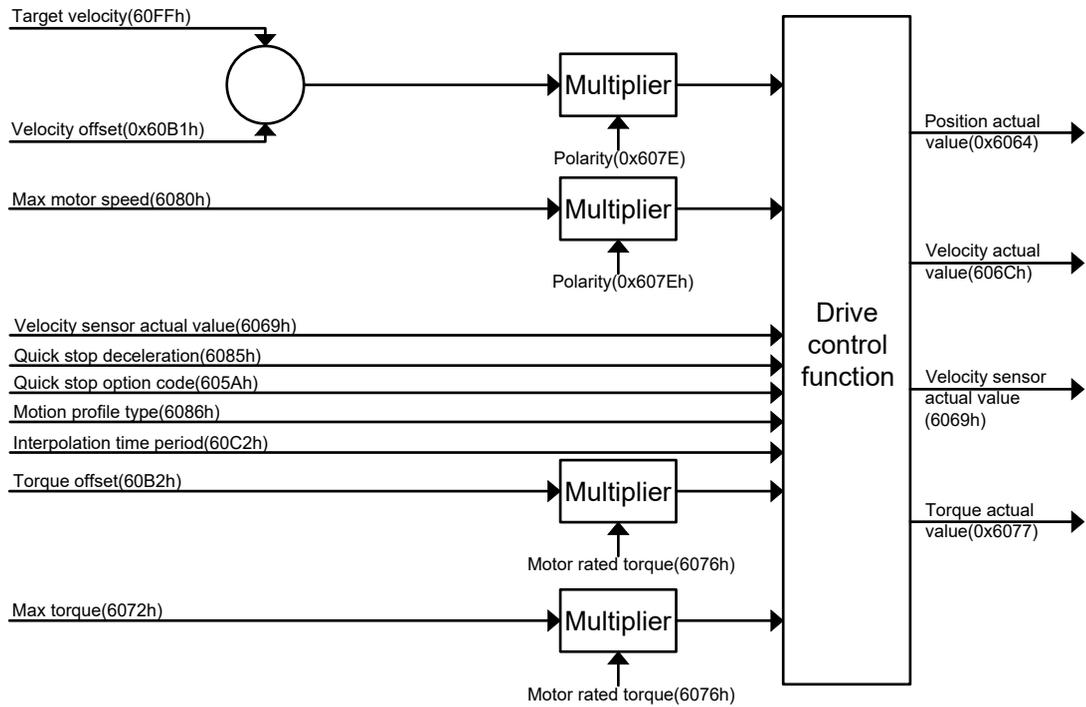
Note: Before the drive mode has changed to CSP and operation mode, the control device should update the target position to the same as the position actual value of drive. If it is not equal to position actual value of drive, the drive will move to new position when operation mode activated.



3.8 Cyclic synchronous velocity mode

3.8.1 General information

With this mode, the trajectory generator is located in the control device, not in the drive device. In cyclic synchronous manner, it provides a target velocity to the drive device, which performs velocity control and torque control.



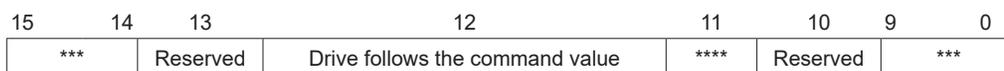
3.8.2 Main controlling object

Index	Name	Type	Access	Mapping
0x6040	Controlword	UINT	WO	YES
0x6041	Statusword	UINT	RO	YES
0x6060	Mode of operation	INT	WO	YES
0x60FF	Target velocity	INT	WO	YES
0x60B1	Velocity offset	DINT	RW	YES
0x6085	Quick stop deceleration	UDINT	RW	NO
0x60FF	Target velocity	DINT	RW	YES

Controlword

The cyclic synchronous position mode uses no mode-specific bits of the controlword .

Statusword



***: See object description

Bit	Value	definition
10	0	Reserved
	1	Reserved
12	0	Target velocity ignored
	1	Target velocity used as input to velocity control loop
13	0	Reserved
	1	Reserved

In the statusword Bit 12 is mandatory.

In CSV mode Bit 10 is used as Status Toggle information to indicate if the device provides updated input data. The bit shall be toggled with every update of the input process data. If object 0x60D9 is supported, the Status Toggle function can be enabled or disabled.

The Bite 12 drive follows the command value shall be zero if the drive does not follow the target value(position,velocity or torque) because of local reasons(internal set-point settings).E.g. if a local Input is configured to a halt function or a safety function prevents the drive in operational to follow the target set point. The control device shal evaluate the bit. The Bit 12 shal be set if the drvie is in state operation enabled and follows the target and set-point values of the control device. In all other cases it shall be zero. If the bit is not supported it shall be fix set to 1 in the statusword.

3.8.3 Functional description

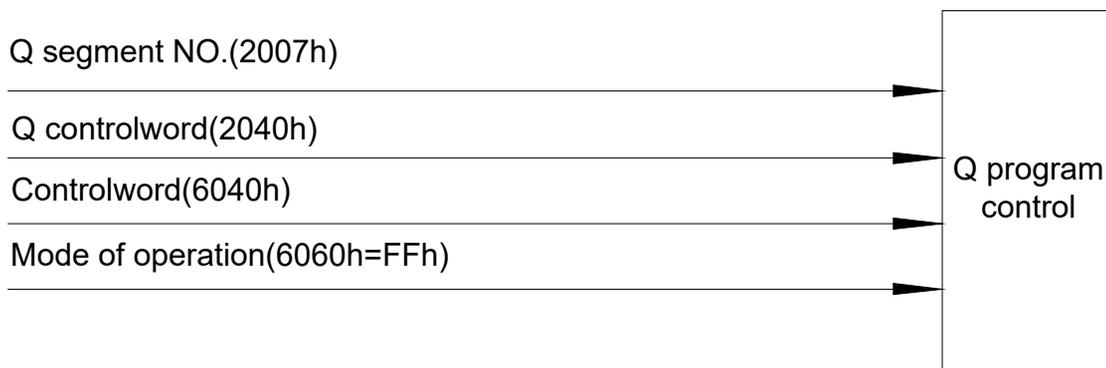
With CSV mode, drive can change speed with every cyclic time. when drive has been to operation mode, the motor speed is located with target velocity(0x60FF) object, change target velocity means change the current velocity on one cyclic time.

The acceleration and deceleration is based on cyclic time and target velocity.

3.9 Q program mode

3.9.1 General information

In order to expand the functionality of MOONS' EtherCAT drives, the Q programming language may be used to execute complex motion profiles that may not be possible within the scope of CiA 402. The Q program must be written and pre-loaded into the EtherCAT drive using Q Programmer. Q Programs may also access and manipulate the EtherCAT General Purpose registers for use in stored programs.



3.9.2 Normal Q execution

To execute a stored Q program on a single drive, a value of -1 (FFh) must be written to the mode of operation OD entry, located at dictionary address 6060h. The mode of operation can be verified using OD entry 6061h - mode of operation display - which is updated when the current operation mode is accepted.

The data of controlling object example of STF-EC and SSDC**-EC drive:**

Event		Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on + enable operation +halt	0x6040=271(10Fh)
Set mode of operation	Normal Q mode	0x6060= -1(FFh)
Set parameter	Q procedure segment	0x2007=1(01h)
Normal Q mode	Start	0x6040=31(1Fh)
	Halt	0x6040=287(011Fh)

The data of controlling object example of STF-ECX and SSDC**-ECX drive:**

Event		Set parameter
Enable motor power	Shut down	0x6040=6(06h)
	Switch on	0x6040=7(07h)
	Switch on+enable operation	0x6040=15(0Fh)
Set mode of operation	Normal Q mode	0x6060=-1(FFh)
Set parameter	Q segment NO.	0x2007=1(01h)
Execute Q program	Enable Q program	0x2040=15(0Fh)
	Start Q program	0x2040=31(1Fh)
	Stop Q program	0x2040=256(100h)

3.10 Touch probe

3.10.1 General information

Touch probe function is used to latch the feedback position by capture the rasing or falling edge of input sensor and index. With touch probe , assign X7 or X8 to touch probe function is essential by the software of MOONS' drive.

3.10.2 Main control object

Index	Name	Type	Access	Mapping
0x60B8	Touch probe function	INT	RW	YES
0x60B9	Touch probe status	UINT	RO	YES
0x60BA	Touch probe pos1 pos value	DINT	RO	YES
0x60BB	Touch probe pos1 neg value	DINT	RO	YES
0x60BC	Touch probe pos2 pos value	DINT	RO	YES
0x60BD	Touch probe pos2 neg value	DINT	RO	YES

3.10.3 Functional description

0x60B8 Touch probe function

This object indicate the configured function of touch probe.

Bit	Value	Definition
0	0	Swith off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	Continous
3,2	00	Trigger with touch probe 1 input
	01	Trigger with zero impulse signal or position encoder
	10	Touch probe source as defined in object 60D0, sub-index01
	11	Reserved
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negtive edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6,7	-	Reserved
8	0	Swith off touch probe 2
	1	Enable touch probe 2
9	0	Trigger first event
	1	Continous
11,10	00	Trigger with touch probe 2 input
	01	Trigger with zero impulse signal or position encoder
	10	Touch probe source as defined in object 60D0, sub-index02
	11	Reserved
12	0	Switch off sampling at positive edge of touch probe 2
	1	Enable sampling at positive edge of touch probe 2
13	0	Switch off sampling at negtive edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
14,15	-	Reserved

0x60B9 Touch probe function

This object provide the status of touch probe.

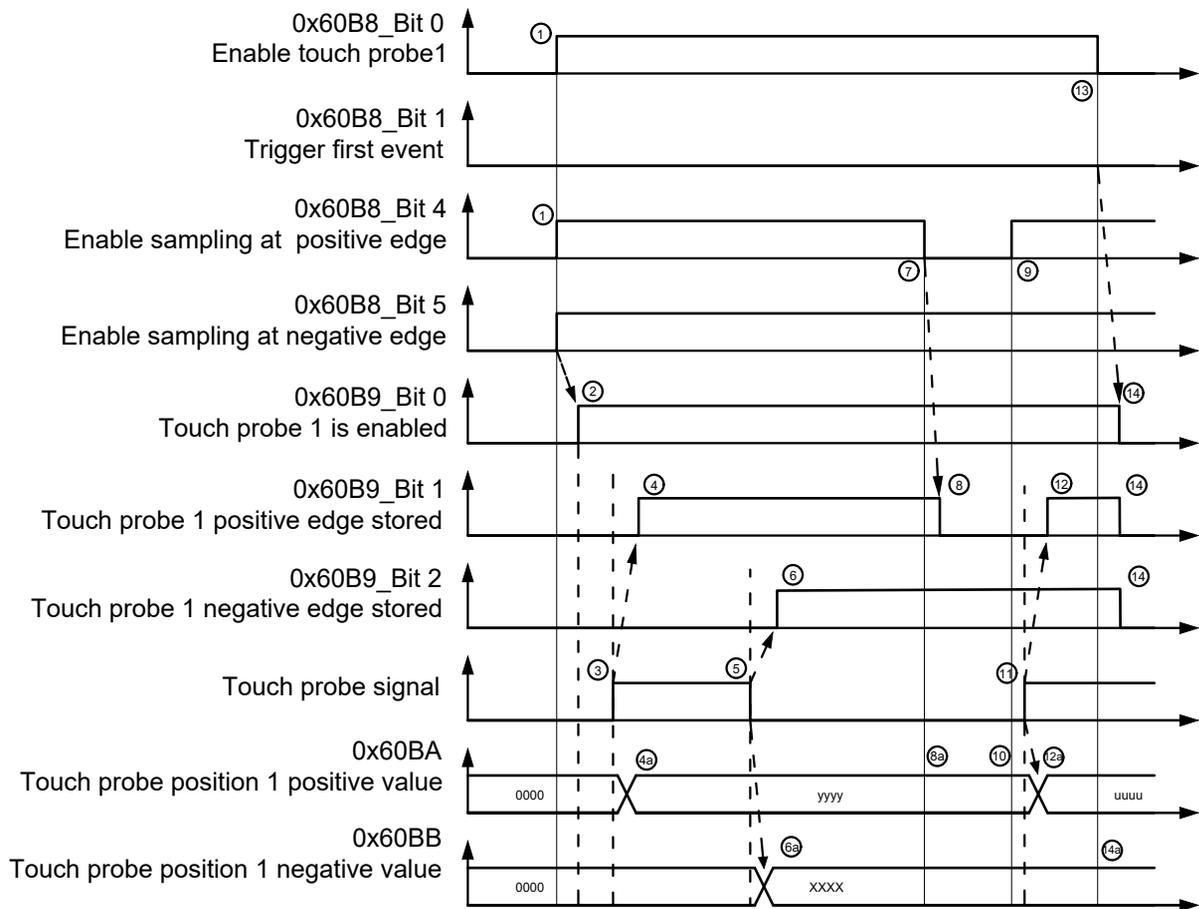
Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no positive edge value stored
	1	Touch probe 1 positive edge position stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 negative edge position stored
3...7	-	Reserved
8	0	Touch probe 2 is switched off
	1	Touch probe 2 is enabled
9	0	Touch probe 2 no positive edge value stored
	1	Touch probe 2 positive edge position stored
10	0	Touch probe 2 no negative edge value stored
	1	Touch probe 2 negative edge position stored
11...15	-	Reserved

0x60BA~0x60BD Touch probe position value

This object shall provide the captual position value of touch probe.

3.10.4 Timing diagramme

The figure in below shows a timing diagram for an example touch probe configuration and the corresponding behavior. And the table explains the timing diagram.



Number	Touch probe behavior	
(1)	60B8_bit0 = 1 60B8_bit1,4,5	Enable touch probe 1 Configure and enable touch probe 1 positive and negative edge
(2)	→60B9_bit 0 = 1	Status"Touch probe 1 enabled" is set
(3)		External touch probe signal has positive edge
(4)	→60B9_bit 1 = 1	Status"Touch probe 1 positive edge stored" is set
(4a)	→60BA	Touch probe position 1 positive value is stored
(5)		External touch probe signal has negative edge
(6)	→60B9_bit 2 = 1	Status"Touch probe 1 negative edge stored" is set
(6a)	60BB	Touch probe positione 1 negative value is stored
(7)	60B8_bit 4 = 0	Sample positive edge is disabled
(8)	→60B9_bit 0 = 0	Status"Touch probe 1 positive edge stored" is reset
(8a)	→60BA	Touch probe position 1 positive value is not changed
(9)	60B8_bit 4 = 1	Sample positive edge is enabled
(10)	→60BA	Touch probe position 1 positive value is not changed
(11)		External touch probe signal has positive edge
(12)	→ 60B9_bit 1 = 1	Status "Touch probe 1 positive edge stored" is set
(12a)	→ 60BA	Touch probe position 1 positive value is stored
(13)	60B8_bit 0 = 0	Touch probe 1 is disabled
(14)	→ 60B9_bit 0, 1, 2 = 0	Status bits are reset
(14a)	→ 60BA, 60BB	Touch probe position 1 positive/negative value are not changed

4 Object dictionary

With CoE protocol, MOONS' Stepper and StepSERVO EtherCAT drives has follow with CANopen specification, the object dictionary is same as CANopen drive. the table obtain the object area of EtherCAT drives in below.

4.1 CoE object dictionary description

Index	Description
0x0000~0x0FFF	Data type area
0x1000~0x1FFF	CoE communication area
0x2000~0x5FFF	Manufacturer specific area
0x6000~0x9FFF	Profile area
0xA000~0xFFFF	Reserved

4.2 Communication profile

	Index	Sub	Name	Access	Type	Mapping
CoE(1000h)	0x1000	-	Device type	RO	UDINT	NO
	0x1001	-	Error register	RO	USINT	NO
	0x1008	-	Device name	RO	STRING(20)	NO
	0x1009	-	Manufacturer hardware version	RO	STRING(4)	NO
	0x100A	-	Manufacturer software version	RO	STRING(4)	NO
	0x1010	-	Store parameters	-	-	-
		1	Store all parameters	RW	UDINT	NO
	0x1011	-	Restore default parameters	-	-	-
		1	Restore default parameters	RW	UDINT	NO
	0x1018	-	Identity object	-	-	-
		1	Vendor ID	RO	UDINT	NO
		2	Product code	RO	UDINT	NO
		3	Revision	RO	UDINT	NO
	0x10F1	4	Serial number	RO	UDINT	NO
		-	Error settings	-	-	-
		1	Local error reaction	RW	UDINT	NO
		2	Sync error counter limit	RW	UINT	NO
	0x1600~1603	8	RPDO mapping parameter 1~4	-	-	-
		1	Mapping entry 1	RW	UDINT	NO
		2	Mapping entry 2	RW	UDINT	NO
		RW	UDINT	NO
		12	Mapping entry 12	RW	UDINT	NO

	Index	Sub	Name	Access	Type	Mapping
CoE(1000h)	0x1A00~1A03	-	TPDO mapping parameter1~4	-	-	-
		1	Mapping entry 1	RW	UDINT	NO
		2	Mapping entry 2	RW	UDINT	NO
		-
		12	Mapping entry 12	RW	UDINT	NO
	0x1C00	-	SYNC manager type	-	-	-
		1	SM0 communication type	RO	USINT	NO
		2	SM1 communication type	RO	USINT	NO
		3	SM2 communication type	RO	USINT	NO
		4	SM3 communication type	RO	USINT	NO
	0x1C12~1C13	-	RxPDO~TxPDO assign	-	-	-
		1	RxPDO~TxPDO 1 mapping object	RW	UINT	NO
		2	RxPDO~TxPDO 1 mapping object	RW	UINT	NO
		3	RxPDO~TxPDO 1 mapping object	RW	UINT	NO
		4	RxPDO~TxPDO 1 mapping object	RW	UINT	NO
	0x1C32~1C33	-	SM output~input parameter	-	-	-
		1	Synchronization type	RW	UINT	NO
		2	Cycle time	RO	UDINT	NO
		3	Shift time	RW	UDINT	NO
		4	Synchronization types supported	RO	UINT	NO
		5	Minimum cycle time	RO	UDINT	NO
		6	Calc and copy time	RO	UDINT	NO
		8	Get cycle time	RW	UINT	NO
		9	Delay time	RO	UDINT	NO
		10	Sync0 cycle time	RW	UDINT	NO
		11	SYNC-Event missed	RO	UINT	NO
		12	Cycle time too small	RO	UINT	NO
	32	Sync error	RO	BOOL	NO	

0x1000 Device type

Contains information about the device type. The object at index 1000h describes the type of device and its functionality. It is composed of a 16-bit field which describes the device profile that is used and a second 16-bit field which gives additional information about optional functionality of the device. The Additional Information parameter is device profile specific. Its specification does not fall within the scope of this document, it is defined in the appropriate device profile. The value 0000h indicates a device that does not follow a standardized device profile.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1000	-	Device type	UDINT32	RO	NO	-

Bit 0-15: Device profile number

Bit 16-31: Additional information

0x1001 Error register

This object is an error register for the device. The device can map internal errors in this byte. This entry is mandatory for all devices. It is a part of an Emergency object.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1001	-	Error register	USINT8	RO	NO	-

Bit 0: generic error

Bit 1: current

Bit 2: voltage

Bit 3: temperature

Bit 4: communication error (overrun, error state)

Bit 5-7: Reserved (always 0)

0x1008 Device name

Contains the manufacturer device name.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1008	-	Manufacturer device name	STRING(20)	CONST	NO	-

Name of the manufacturer as string.

0x1009 Hardware version

Contains the hardware version description.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1009	-	Hardware version	STRING(4)	CONST	NO	-

0x100A Software version

Contains the software version description.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x100A	-	Software version	STRING(4)	CONST	NO	-

0x1010 Store parameters

This object supports the saving of parameters in non-volatile memory. By read access the device provides information about its saving capabilities. Several parameter groups are distinguished:

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1010	0	Number of sub-index	USINT8	RO	NO	1
	1	Store parameters	UDINT32	RW	NO	0

In order to avoid storage of parameters by mistake, storage is only executed when a specific signature is written to the appropriate Sub-Index 1. The signature is "save".

	MSB		LSB	
Signature ISO	e	v	a	s
8859("ASCII")hex	65h	76h	61h	73h

Storage write access signature

0x1011 Restore default parameters

With this object the default values of parameters according to the communication or device profile are restored.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1011	0	Number of sub-index	USINT8	RO	NO	1
	1	Restore parameters	UDINT32	RW	NO	0

In order to avoid storage of parameters by mistake, storage is only executed when a specific signature is written to the appropriate Sub-Index 1. The signature is "load".

	MSB		LSB	
Signature ISO	e	v	a	s
8859("ASCII")hex	64h	61h	6Fh	6Ch

Storage write access signature

0x1018 Identity object

The object at index 1018h contains general information about the device.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1018	0	Number of sub-index	USINT8	RO	NO	4
	1	Vendor-ID	UDINT32	RO	NO	-
	2	Product code	UIDINT32	RO	NO	-
	3	Revision number	UDINT32	RO	NO	-
	4	Serial number	UDINT32	RO	NO	-

0x10F1 Error settings

Reserved.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x10F1	0	Number of sub-index	USINT8	RO	NO	4
	1	Local error reaction	UDINT32	RW	NO	1
	2	SYNC error counter limit	UIDINT32	RW	NO	4

0x1600~1603 Receive PDO mapping parameter

Contains the mapping for the PDOs the device is able to receive.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1600-1603	0	Number of sub-index	USINT8	RW	NO	4
	1	Mapping entry 1	UDINT32	RW	NO	-
	2	Mapping entry 2	UIDINT32	RW	NO	-
	3	Mapping entry 3	UDINT32	RW	NO	-
	4	Mapping entry 4	UDINT32	RW	NO	-
	5	Mapping entry 5	UDINT32	RW	NO	-
	6	Mapping entry 6	UDINT32	RW	NO	-
	7	Mapping entry 7	UDINT32	RW	NO	-
	8	Mapping entry 8	UDINT32	RW	NO	-
	9	Mapping entry 9	UDINT32	RW	NO	-
	10	Mapping entry 10	UDINT32	RW	NO	-
	11	Mapping entry 11	UDINT32	RW	NO	-
	12	Mapping entry 12	UDINT32	RW	NO	-

0x1A00~1A03 Transmit PDO mapping parameter

Contains the mapping for the PDOs the device is able to transmit.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1A00-1A03	0	Number of sub-index	USINT8	RW	NO	12
	1	Mapping entry 1	UDINT32	RW	NO	-
	2	Mapping entry 2	UIDINT32	RW	NO	-
	3	Mapping entry 3	UDINT32	RW	NO	-
	4	Mapping entry 4	UDINT32	RW	NO	-
	5	Mapping entry 5	UDINT32	RW	NO	-
	6	Mapping entry 6	UDINT32	RW	NO	-
	7	Mapping entry 7	UDINT32	RW	NO	-
	8	Mapping entry 8	UDINT32	RW	NO	-
	9	Mapping entry 9	UDINT32	RW	NO	-
	10	Mapping entry 10	UDINT32	RW	NO	-
	11	Mapping entry 11	UDINT32	RW	NO	-
	12	Mapping entry 12	UDINT32	RW	NO	-

0x1C00 Sync manager type

The sync manager communication type set the communication type of each SM manager. The type of communication that:

1. Mailbox reception
2. Mailbox sending
3. RxPDO
4. TxPDO

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1C00	0	Number of sub-index	USINT8	RW	NO	4
	1	SM0 communication type	UDINT32	RW	NO	1
	2	SM1 communication type	UDINT32	RW	NO	2
	3	SM2 communication type	UDINT32	RW	NO	3
	4	SM3 communicaiton type	UDINT32	RW	NO	4

0x1C12 RxPDO assign object

The sync manager of RxPDO allocation, sub-indx1-4 set to the index of mapping.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1C12	0	Number of sub-index	USINT8	RW	NO	1
	1	RxPDO1 mapping object	UDINT32	RW	NO	0x1600
	2	RxPDO2 mapping object	UDINT32	RW	NO	-
	3	RxPDO3 mapping object	UDINT32	RW	NO	-
	4	RxPDO4 mapping object	UDINT32	RW	NO	-

0x1C13 TxPDO assign object

The sync manager of TxPDO allocation, sub-indx1-4 set to the index of mapping.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1C13	0	Number of sub-index	USINT8	RW	NO	1
	1	TxPDO1 mapping object	UDINT32	RW	NO	0x1A00
	2	TxPDO2 mapping object	UDINT32	RW	NO	-
	3	TxPDO3 mapping object	UDINT32	RW	NO	-
	4	TxPDO4 mapping object	UDINT32	RW	NO	-

0x1C32 SM output parameter

The SYNC manager parameter.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1C32	0	Number of sub-index	USINT8	RO	NO	32
	1	Synchronization type	UINT16	RW	NO	2
	2	Cycle time	UDINT32	RO	NO	0
	3	Shift time	UDINT32	RW	NO	0
	4	Synchronization types supported	UDINT32	RO	NO	0x401F
	5	Minimum cycle time	UDINT32	RO	NO	0x7A120
	6	Calc and copy time	UINT16	RW	NO	0
	8	Get cycle time	UINT	RW	NO	0
	9	Delay time	UDINT	RO	NO	0
	10	Sync0 cycle time	UDINT	RW	NO	0x3D0900
	11	SM-event missed	UINT	RO	NO	0
	12	Cycle time too small	UINT	RO	NO	0
	32	Sync error	BOOL	RO	NO	false

0x1C33 SM input parameter

The SYNC manager parameter.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x1C33	0	Number of sub-index	USINT8	RO	NO	32
	1	Synchronization type	UINT16	RW	NO	2
	2	Cycle time	UDINT32	RO	NO	0
	3	Shift time	UDINT32	RW	NO	0
	4	Synchronization types supported	UDINT32	RO	NO	0x401F
	5	Minimum cycle time	UDINT32	RO	NO	0x7A120
	6	Calc and copy time	UINT16	RW	NO	0
	8	Get cycle time	UINT	RW	NO	0
	9	Delay time	UDINT	RO	NO	0
	10	Sync0 cycle time	UDINT	RW	NO	0x3D0900
	11	SM-event missed	UINT	RO	NO	0
	12	Cycle time too small	UINT	RO	NO	0
	32	Sync error	BOOL	RO	NO	false

4.3 Motion control profile

	Index	Sub	Name	Access	Type	Mapping
CoE(6000)	0x603F	-	Error code	RO	UINT16	YES
	0x6040	-	Controlword	WO	UINT16	YES
	0x6041	-	Statusword	RO	UINT16	YES
	0x605A	-	Quick stop option code	RW	INT16	NO
	0x605B	-	Shut down option code	RW	INT16	NO
	0x605C	-	Disable operation option code	RW	INT16	NO
	0x605D	-	Halt option code	RW	INT16	NO
	0x605E	-	Fault reaction code	RW	INT16	NO
	0x6060	-	Modes of operation	WO	INT8	YES
	0x6061	-	Modes of operation display	RO	INT8	YES
	0x6064	-	Position actual value	RO	INT32	YES
	0x6065	-	Following error window	RW	UINT32	NO
	0x606C	-	Velocity actual value	RO	INT32	YES
	0x6071	-	Target torque	RW	INT16	YES
	0x6073	-	Max current	RW	UINT16	YES
	0x6074	-	Torque demand	RO	INT16	YES
	0x6077	-	Torque actual value		INT	YES
	0x6078	-	Current actual value	RO	INT16	YES
	0x607A	-	Target position	RW	INT32	YES
	0x607C	-	Home offset	RW	INT32	YES
	0x607D	-	Software position limit	-	-	-
		1	Min position limit	RW	DINT	NO
		2	Max position limit	RW	DINT	NO
	0x607E	-	Polarity	RW	UINT8	YES
	0x607F	-	Max profile velocity	RW	UINT32	YES
	0x6081	-	Profile velocity	RW	UINT32	YES
	0x6083	-	Profile acceleration	RW	UINT32	YES
	0x6084	-	Profile deceleration	RW	UINT32	YES
	0x6085	-	Quick stop deceleration	RW	UINT32	YES
	0x6087	-	Torque slope	RW	UINT32	YES
	0x6098	-	Homing method	RW	INT8	YES
	0x6099	-	Homing speed	-	ARRAY	-
		1	Search switch	RW	UDINT	YES
		2	Search zero	RW	UDINT	YES
	0x609A	-	Homing acceleration	RW	UDINT32	YES
	0x60B0		Position offset	RW	DINT32	YES
	0x60B1	-	Velocity offset	RW	DINT	YES
	0x60B2		Torque offset	RW	DINT	YES
	0x60B8		Touch probe function	RW	UINT	YES
	0x60B9		Touch probe status	RO	UINT	YES

	Index	Sub	Name	Access	Type	Mapping
CoE(6000)	0x60BA		Touch probe pos1 pos value	RO	DINT	YES
	0x60BB		Touch probe pos2 pos value	RO	DINT	YES
	0x60BC		Touch probe pos3 pos value	RO	DINT	YES
	0x60BD		Touch probe pos4 pos value	RO	DINT	YES
	0x60E0		Positive torque limit value	RW	UINT	YES
	0x60E1	-	Negative torque limit value	RW	UINT	YES
	0x60F4	-	Following error actual value	RO	DINT	YES
	0x60FD	-	Digital inputs	RO	UDINT	YES
	0x60FE	2	Digital outputs	-	ARRAY	NO
	0x60FF	-	Target velocity	RW	DINT	YES
		1	Physical outputs	RW	UDINT	YES
		2	Bit mask	RW	UDINT	NO
	0x6502	-	Supported drive modes	RO	UDINT	NO

0x603F Error code

The error code captures the alarm code of the last error that occurred in the drive.

Index	Sub	Name	Data Type	Access Type	PDO mapping	Default Value
0x603F	-	Error code	UINT	RO	YES	-

Each bit in code indicate one type alarm or faults status.

Error Code	Description
0x7500	EtherCAT Communication Error
0xFF01	Over Current
0xFF02	Over Voltage
0xFF03	Over Temperature
0xFF04	Open Motor Winding
0xFF05	Internal Voltage Bad
0xFF06	Position limit
0xFF07	Encoder bad
0xFF08	Fc position limit
0xFF09	Fc encoder bad
0xFF0A	Regen failed
0xFF0B	STO
0xFF31	CW Limit
0xFF32	CCW Limit
0xFF33	CCW CW limit
0xFF34	Current limit
0xFF35	Move When Disable
0xFF36	Voltage Low
0xFF37	Qprogram Blank
0xFF41	Save Failed
0xFF42	Xmlread Failed
0xFFFF	Other Error

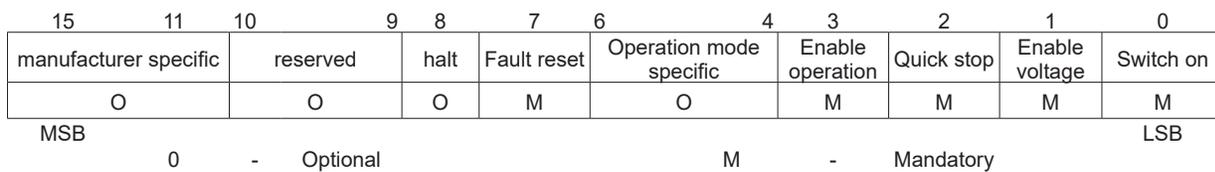
0x6040 Controlword

This object shall indicate the received command controlling the PDS FSA. The bits 7, 3, 2, 1, and 0 shall be supported. The bits 0 to 9 shall be supported according to the mode of operation. If the related functionality is not available, an appropriate emergency message shall be generated. The manufacturer-specific bits may be supported.

All implemented bits of the controlword are valid independent of the PDS FSA state. Starting of any movement is operation mode specific and is described in the related clause.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6040	-	Controlword	RW	UINT	YES	-

The bits of the controlword are defined as follows:



0x6041 Statusword

The status word indicates the current state of the drive. No bits are latched. The status word consist of bits for:

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6041	-	Statusword	RO	UINT	YES	-

The bits of the statusword are defined as follows:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ms		oms		ila	tr	rm	ms	w	sod	qs	ve	f	oe	so	rtso

- Key:
- ms manufacturer specific
 - oms operation mode specific
 - ila internal limit active
 - tr target reached
 - rm remote
 - w warning
 - sod switch on disabled
 - qs quick stop
 - ve voltage enabled
 - f fault
 - oe operation enabled
 - so switched on
 - rtso ready to switch on

statusword(6041h)	PDS FSA state
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Switch on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

0x605A Quick stop option code

The parameter quick stop option code determines what action should be taken if the Quick Stop Function is executed.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x605A	-	Quick stop option code	RW	INT	NO	-

Quick stop option code	Action
-32768...-1	Manufacturer Specific
0	Disable drive function
1	Slow down on slow down ramp and transit into switch on disabled
2	Slow down on quick stop ramp and transit into switch on disabled
3	Slow down on the current limit and transit into switch on disabled
4	Slow down on the voltage limit and transit into switch on disabled
5	Slow down on slow down ramp and stay in quick stop active
6	Slow down on quick stop ramp and stay in quick stop active
7	Slow down on slow current limit and stay in quick stop active
8	Slow down on voltage limit and stay in quick stop active
9...32767	Reserved

It is only supported of option code 1 and 2 feature at this moment.

0x605B Shutdown option code

This object shall indicate what action is performed if there is a transition from operation enabled state to ready to switch on state. The slow down ramp is the deceleration value of the used mode of operations.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x605B	-	Shutdown option code	RW	INT	NO	-

Value	Action
-32768...-1	Manufacturer Specific
0	Disable drive function(switch-off drive power stage)
1	Slow down on slow down ramp disable of the drive function
2...32767	Reserved

0x605C Disable operation option code

This object shall indicate what action is performed if there is a transition from operation enabled state to switched on state. The slow down ramp is the deceleration value of the used mode of operations.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x605C	-	Disable operation option code	RW	INT	NO	-

Value	Action
-32768...-1	Manufacturer Specific
0	Disable drive function(switch-off drive power stage)
1	Slow down on slow down ramp and then disable of the drive function
2...32767	Reserved

0x605D Halt option code

This object shall indicate what action is performed when the halt function is executed. The slow down ramp is the deceleration value of the used mode of operations.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x605D	-	Halt option code	RW	INT	NO	-

Value	Action
-32768...-1	Manufacturer Specific
0	Reserved
1	Slow down on slow down ramp and stay in operation enabled
2	Slow down on quick stop ramp and stay in operation enabled
3	Slow down on current limit and stay in operation enabled
4	Slow down on voltage limit and atay in operation enabled
5 + 32767	Reserved

0x605E Fault reaction option code

This object shall indicate what action is performed when fault is detected in the PDS. The slow down ramp is the deceleration value of the used mode of operations.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x605E	-	Fault reaction option code	RW	INT	NO	-

Value	Action
-32768...-1	Manufacturer Specific
0	Disable drive function, motor is free t rotate
1	Slow down on slow down ramp
2	Slow down on quick stop ramp
3	Slow down on current limit
4	Slow down on voltage limit
5 + 32767	Reserved

0x6060 Mode of operation

The parameter modes of operation switches the actually chosen operation mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6060	-	Mode of operation	RW	SINT	NO	-

Mode of operation	Value
Profile position mode	1
Profile velicity mode	3
Profile Torque mode	4
Homing mode	6
Cynclis synchronous position mode	8
Cynclis synchronous velocity mode	9
Q mode(manufacturer specific mode)	-1

0x6061 Mode of operation display

The modes of operation display shows the current mode of operation. The meaning of the returned value corresponds to that of the modes of operation option code (index 6060_n).

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6060	-	Modes of operation display	RO	SINT	YES	-

0x6064 Position actual value

This object represents the actual value of the position.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6064	-	Position actual value	RO	DINT	YES	-

0x6065 Following error window

The following error window defines a range of tolerated position values symmetrically to the position demand value. It is the position fault limit in encoder counts. As it is in most cases used with user defined units, a transformation into increments with the position factor is necessary. If the position actual value is out of the following error window, a following error occurs

A following error might occur when:

- A drive is blocked
- Unreachable profile velocity occurs
- At wrong closed loop coefficients

If the value of the following error window is 0 ,the following control is switched off.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6065	-	Following error window	RW	UDINT	NO	-

0x606C Velocity actual value

The velocity actual value is also represented in velocity units and is coupled to the velocity used as input to the velocity controller.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x606C	-	Velocity actual value	RO	DINT	YES	-

The unit of this object is in counts/s.

0x6071 Target torque

This parameter is the input value for the torque controller in profile torque mode and the value is given per thousand of rated torque.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6071	-	Target torque	RW	INT	YES	-

This object only can be accessed in StepSERVO drives and this object parameters is related to the other torque values, such as current actual value (index 0x6078) and torque constant (index 0x2216).

0x6073 Max current

This value represents the maximum permissible torque creating current in the motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6073	-	Max current	RW	UINT	NO	-

The unit of this object is 0.01Amps.

0x6074 Torque demand

This parameter is the output value of the torque limit function (if the torque control and power-stage function are available).

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6074	-	Torque demand value	RO	INT	YES	-

This object is only available on StepSERVO drives and the unit of this object is mNm.

0x6077 torque actual value

This object shall provide the actual value of the torque. It shall correspond to the instantaneous torque in the motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6077	-	Torque actual value	RO	INT	YES	-

0x6078 Current actual value

This object shall provide the actual value of the current. It shall correspond to the current in the motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6078	-	Current actual value	RO	INT	YES	-

This object is only available on StepSERVO drives and the unit of object is 0.01Amps.

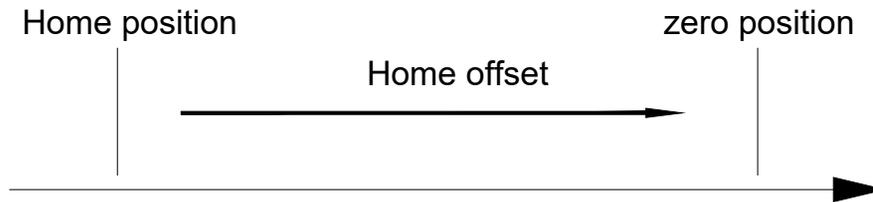
0x607A Target position

This object is the position that the drive should move to in position profile mode using the current settings of motion control parameters such as velocity, acceleration, deceleration, motion profile type etc. The target position is given in terms of Electrical Gear parameters steps per motor shaft revolution. The target position will be interpreted as absolute or relative depending on the 'abs / rel' flag in the contword.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x607A	-	Target position	RW	DINT	YES	-

0x607C Home offset

The home offset object is the difference between the zero position for the application and the machine home position (found during homing), it is measured in position units. 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 shall be taken relative to this new zero position. This is illustrated in the following diagram.

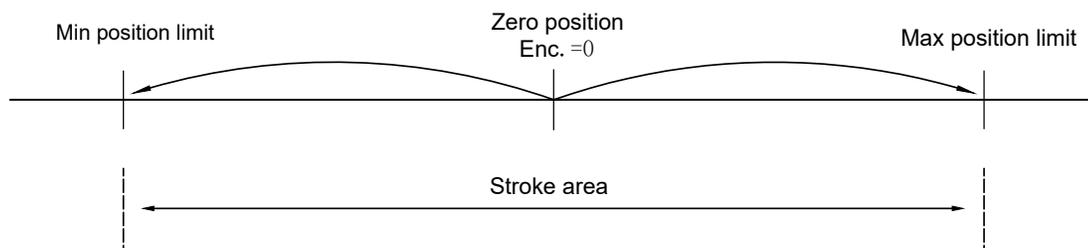


Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x607C	-	Home offset	RW	DINT	YES	-

0x607D Software position limit

This object shall indicate the configured maximal and minimal software position limits. These parameters shall define the absolute position limits for the position demand value and the position actual value as specified in below.

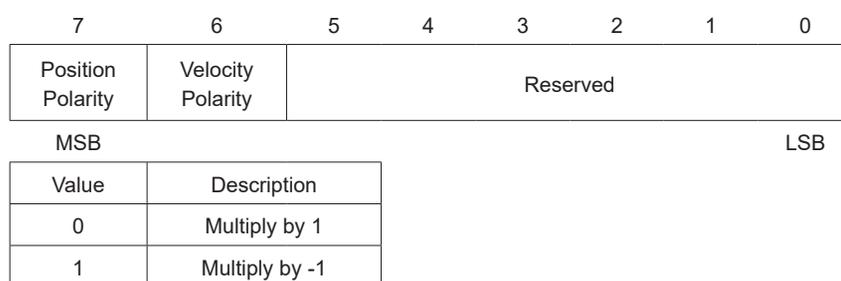
Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x607D	0	Number of sub-index	RW	USINT8	NO	2
	1	Min position limit	RW	DINT	NO	-
	2	Max position limit	RW	DINT	NO	-



0x607E Polarity

Position demand value and position actual value are multiplied by 1 or -1 depending on the value of the polarity flag. PP PV Mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x607E	-	Polarity	RW	USINT	YES	-



0x607F Max profile speed

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

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x607F	-	Max profile speed	RW	UDINT	YES	-

The unit of this object is in counts/s.

0x6081 Profile velocity

The profile velocity is the velocity normally attained at the end of the acceleration ramp during a profiled move and is valid for both directions of motion.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6081	-	Profile velocity	RW	UDINT	YES	-

The unit of this object is in counts/s.

0x6083 Profile acceleration

The profile acceleration is given in counts/s². It is converted to position increments per second² using the normalizing factors.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6083	-	Profile acceleration	RW	UDINT	YES	-

0x6084 Profile deceleration

The profile deceleration is given in the same units as profile acceleration.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6084	-	Profile deceleration	RW	UDINT	YES	-

0x6085 Quick stop deceleration

The quick stop deceleration is the deceleration used to stop the motor if the 'Quick Stop' command is given and the quick stop option code (see 605Ah) is set to 2. The quick stop deceleration is given in the same units as the profile acceleration.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6085	-	Quick stop deceleration	RW	UDINT	NO	-

0x6087 Torque slope

This parameter describes the rate of change of torque in units of per thousand of rated torque per second.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6087	-	Torque slope	RW	UDINT	YES	-

The units is Nm/s.

0x6098 Home method

The homing method object determines the method that will be used during homing.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6098	-	Home method	RW	SINT	YES	-

Value	Description
128	manufacturer specific
0	No homing operation required
1...37	Methods 1 to 37
38-127	Reserved

0x6099 Homing speed

This entry in the object dictionary defines the speeds used during homing.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6099	0	Number of sub-index	RW	USINT8	NO	2
	1	Search switch	RW	UDINT	NO	-
	2	Search zero	RW	UDINT	NO	-

The value shall be given in counts/s.

0x609A Homing acceleration

The homing acceleration establishes the acceleration to be used for all accelerations and decelerations with the standard homing modes.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x609A	-	Homing acceleration	RW	UDINT	YES	-

The value units should be the same as profile acceleration/deceleration objects.

0x60B0 Position offset

This object shall provide the offset of the target position.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60B0	-	Position offset	RW	DINT	YES	-

0x60B1 Velocity offset

This object shall provide the offset for the velocity value. In cyclic synchronous position mode, this object contains the input value for velocity feed forward. In cyclic synchronous velocity mode, it contains the commanded offset of the drive device.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60B1	-	Velocity offset	RW	DINT	YES	-

0x60B2 Torque offset

This object shall provide the offset for the torque value. In cyclic synchronous position mode and cyclic synchronous velocity mode, this object contains the input value for torque feed forward. In cyclic synchronous torque mode. it contains the commanded additive torque of the drive, which is added to the target torque value.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60B2	-	Torque offset	RW	INT	YES	-

0x60B8 Touch probe function

This object shall indicate the configured function of the touch probe.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60B8	-	Touch probe function	RW	UINT	YES	-

Bit	Value	Definition
0	0	Swith off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	Continous
3,2	00	Trigger with touch probe 1 input
	01	Trigger with zero impulse signal or position encoder
	10	Touch probe source as defined in object 60D0, sub-index01
	11	Reserved
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negtive edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6,7	-	Reserved
8	0	Swith off touch probe 2
	1	Enable touch probe 2
9	0	Trigger first event
	1	Continous
11,10	00	Trigger with touch probe 2 input
	01	Trigger with zero impulse signal or position encoder
	10	Touch probe source as defined in object 60D0, sub-index02
	11	Reserved
12	0	Switch off sampling at positive edge of touch probe 2
	1	Enable sampling at positive edge of touch probe 2
13	0	Switch off sampling at negtive edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
14,15	-	Reserved

0x60B9 Touch probe status

This object shall provide the status of the touch probe.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60B9	-	Velocity offset	RW	DINT	YES	-

Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no positive edge value stored
	1	Touch probe 1 positive edge position stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 negative edge position stored
3...7	-	Reserved
8	0	Touch probe 2 is switched off
	1	Touch probe 2 is enabled
9	0	Touch probe 2 no positive edge value stored
	1	Touch probe 2 positive edge position stored
10	0	Touch probe 2 no negative edge value stored
	1	Touch probe 2 negative edge position stored
11...15	-	Reserved

0x60BA Touch probe 1 positive edge

This object shall provide the position value of the touch probe 1 at positive edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60BA	-	Touch probe 1 positive edge	RO	DINT	YES	-

0x60BB Touch probe 1 negative edge

This object shall provide the position value of the touch probe 1 at negative edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60BB	-	Touch probe 1 negative edge	RO	DINT	YES	-

0x60BC Touch probe 2 positive edge

This object shall provide the position value of the touch probe 2 at positive edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60BD	-	Touch probe 1 negative edge	RO	DINT	YES	-

0x60BD Touch probe 2 negative edge

This object shall provide the position value of the touch probe 2 at negative edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60BD	-	Touch probe 1 negative edge	RO	DINT	YES	-

0x60E0 Positive torque limit value

This object shall indicate the configured maximum positive torque in the motor. Positive torque takes effect in the case of motive operation is positive velocity or regenerative operation is negative velocity.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60E0	-	Positive torque limit value	RW	UINT	YES	-

0x60E1 Negative torque limit value

This object shall indicate the configured maximum negative torque in the motor. Negative torque takes effect in the case of motive operation is negative velocity or regenerative operation is positive velocity.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60E1	-	Positive torque limit value	RW	UINT	YES	-

0x60F4 Follow error actual value

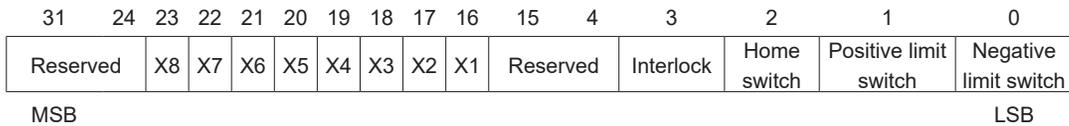
This object shall provide the actual value of the following error.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60F4	-	Follow error actual value	RO	DINT	YES	-

0x60FD Digital inputs

This object shall provide digital inputs. This object shall represent the logical input levels.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60FD	-	Digital inputs	RO	UDINT	YES	-



Bit 3 (interlock) provides the state of the interlock input. If the logical input signal changes to not activated, the drive shall enter the switch on disabled or fault reaction active state. This means the power stage of the drive is disabled and locked against switching on.

0x60FE Digital outputs

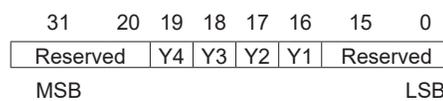
This object shall command the digital outputs. This object shall represent the logical output levels.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60FE	0	Number of sub-index	RW	USINT8	NO	2
	1	Physical outputs	RW	UDINT	YES	-
	2	Bit mask	RW	UDINT	NO	-

The first sub-index defines the assigned outputs. The second sub-index describes a mask to specify which of the outputs shall be used.

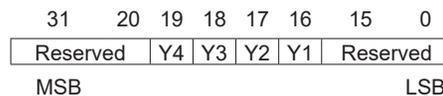
Note: the second sub-index are edge triggered, you must set the second sub-index first and then set the bit of first sub-index for change the status of output.

Physical outputs:



Field	Value	Definition
Each bit	0	Switch off
	1	Switch on

Bit mask:



Field	Value	Definition
Each bit	0	Disable output
	1	Enable output

0x60FF Target velocity

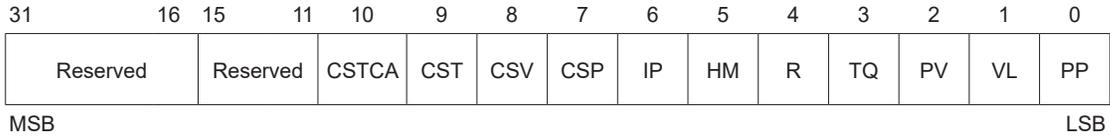
This object shall indicate the configured target velocity and shall be used as input for the trajectory generator. The value shall be given in counts/s.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x60FF	-	Target velocity	RW	DINT	YES	-

0x6502 Supported drive modes

This object shall provide information on the supported drive modes.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x6502	-	Supported drive modes	RO	UDINT	NO	-



The supported mode in Moons' EtherCAT drive:

- Bit0: Profile Position Mode
- Bit2: Profile Velocity Mode
- Bit3: Profile Torque Mode (StepSERVO)
- Bit5: Homing Mode
- Bit7: CSP
- Bit8: CSV

4.4 Manufacturer profile

0x2000~ 2100h	Index	Sub	Name	Access	Type	Mapping
	0x2001	-	Home switch	RW	UINT8	YES
	0x2002	-	Output status	RO	UDINT	NO
	0x2006	-	Clear alarm	WO	UINT8	YES
	0x2007	-	Q segment NO.	RW	UINT8	YES
	0x200B	-	DSP status code	RO	UINT32	YES
	0x200C	-	Zero position	WO	UINT8	NO
	0x200F	-	DSP alarm code	RO	UINT32	YES
	0x2019	-	Device temperature	RO	UINT	NO
	0x201F	-	S-Curve filter time	RW	UINT	NO
	0x2020	-	Physical address	RW	UINT16	NO
	0x2021	-	EtherCAT ID	RW	UINT16	NO
	0x2022	-	Alias source	RO	UINT	NO
	0x2030	-	Bus voltage	RO	UINT16	NO
	0x2031	-	DSP version	RO	STRING(10)	NO
	0x2036	-	Move homeoffset	RW	UINT	NO
	0x2040	-	Q controlword	RW	UINT	YES
	0x2041	-	Q statusword	RW	UINT	YES
	0x2100	-	User registers	-	-	-
	1	User register 1	RW	DINT	YES	
	2	User register 2	RW	DINT	YES	
	
	23	User register 23	RW	DINT	YES	

0x2001 Home switch

This object shall configure the number of Inputs as the Home switch in Homing mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2001	-	Home switch	RW	USINT	NO	-

Value	8	7	6	5	4	3	2	1
Output	X8	X7	X6	X5	X4	X3	X2	X1

0x2002 Output status

This object shall indicate the digital output status.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2002	-	Output status	RO	UDINT	NO	0x000F0000

Bit	31	20	19	18	17	16	15	0
Output	Reserved	Y4	Y3	Y2	Y1	Reserved		

0x2006 Clear alarm

This object provides the feature to clear alarm of the drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2006	-	Clear alarm	RW	USINT	YES	-

STF**-EC, SSDC**-EC: Set to 0x01 can clear all alarm

STF**-ECX, SSDC**-ECX: Set the value with 0x55 to 0xAA can clear all alarm

0x2007 Q segment NO.

This object shall configure the number of Q Segment will be executed in Q mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2007	-	Q segment NO.	RW	USINT	YES	0

0x200B DSP status code

This object represents the current status code of the drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x200B	-	DSP status code	RO	UDINT	YES	-

BIT	Status Code Bit Definition
0	Motor Enabled - motor disabled is this bit = 0
1	Sampling - for Quick Tuner
2	Drive Fault - check alarm code
3	In Position - motor is in position
4	Moving - motor is moving
5	Jogging - currently in jog mode
6	Stopping - in the process of stopping from a stop command
7	Waiting - for an input
8	Saving - parameter data is being saved
9	Alarm present - check alarm code
10	Homing - executing an SH command
11	Wait Time - executing a WT command
12	Wizard running - timing wizard is running
13	Checking encoder - timing wizard is running
14	Q Program is running
15	Initializing

0x200C Zero position

This object provides the feature to zero all position parameters, such as position actual value (which index is 0x6064h).Set this value to 01h can zero all position parameters.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x200C	-	Zero position	RW	USINT	NO	-

0x200F DSP alarm code

This object shall indicate the high 16bit field of alarm code about the object at 0x603F.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x200F	-	DSP alarm code	RO	UDINT	YES	-

0x2019 Device temperature

This object contains the information of device temperature.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2019	-	Device temperature	RO	UINT	NO	-

The unit of this object is in 0.1 centigrade.

0x201F S-Curve filter time

This object is used to be set the S-Curve filter time.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x201F	-	S-Curve filter time	RW	UINT	NO	-

0x2020 Physical address

This object contains the physical address of drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2020	-	Physical address	RO	UINT	NO	-

0x2021 EtherCAT ID

This object contains the EtherCAT ID of drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2021	-	EtherCAT ID	RO	UINT	NO	-

0x2022 Alias source

This object is used to set the method of EtherCAT address setting. The value is 0 means that set by software, 1 means set by the EtherCAT master.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2022	-	Alias source	RO	UINT	NO	-

0x2030 Bus voltage

This object shall provide the present value of drive's DC bus voltage.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2030	-	Bus voltage	RO	UINT	NO	-

The voltage reads out in 0.1 volts resolution.

0x2031 DSP version

This object shall provide the DSP version of the drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2031	-	DSP version	RO	STRING(10)	NO	-

0x2036 Homing offset mode

This object is used to set homing offset mode.

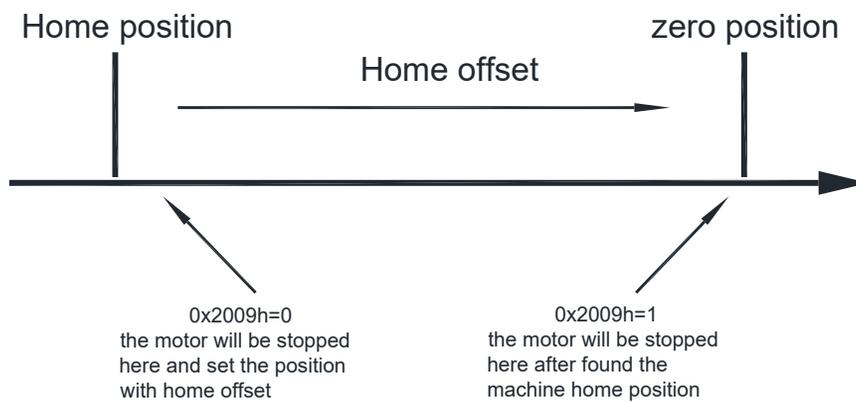
Object Type	Data Type	Access Type	PDO mapping	COS	Default Value
VAR	UINT16	RW	NO	NO	0

Set the value to 0:

The motor will be stopped on machine home position and the current position value is the home offset.

Set the value to 1:

The motor will moving with a distance that home offset provided after the machine home position has found. The new position is the zero position.



0x2040 Q controlword

This object is used to execute the Q program.

Index	Sub	Name	Access type	Date type	PDO mapping	Default value
0x2040	-	Q controlword	RW	UINT	YES	0

0x2041 Q controlword

This object provide the status of Q program.

Index	Sub	Name	Access type	Date type	PDO mapping	Default value
0x2041	-	Q statusword	RO	UINT	YES	0x400

The value is 0x400 means that the Q program is not running, 0x000 means that is running.

0x2100 User registers

This object provide user 23 general purpose registers. They are volatile, so the information sent there will not be saved after a power cycle.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2100	0	Number of sub-index	RO	USINT	NO	23
	1	User register1	RW	DINT	YES	-
	2	User register2	RW	DINT	YES	-
	3	User register3	RW	DINT	YES	-
	4	User register4	RW	DINT	YES	-
	5	User register5	RW	DINT	YES	-
	6	User register6	RW	DINT	YES	-
	7	User register7	RW	DINT	YES	-
	8	User register8	RW	DINT	YES	-
	9	User register9	RW	DINT	YES	-
	10	User register10	RW	DINT	YES	-
	11	User register11	RW	DINT	YES	-
	12	User register12	RW	DINT	YES	-
	13	User register13	RW	DINT	YES	-
	14	User register14	RW	DINT	YES	-
	15	User register15	RW	DINT	YES	-
	16	User register16	RW	DINT	YES	-
	17	User register17	RW	DINT	YES	-
	18	User register18	RW	DINT	YES	-
	19	User register19	RW	DINT	YES	-
	20	User register20	RW	DINT	YES	-
	21	User register21	RW	DINT	YES	-
	22	User register22	RW	DINT	YES	-
23	User register23	RW	DINT	YES	-	

4.5 Manufacturer parameter for StepSERVO

	Index	Sub	Name	Access	Type	Mapping
0x2200~ 2300h	0x2200	-	Continuous current	RW	UINT	NO
	0x2201	-	Peak current	RW	UINT	NO
	0x2202	-	Hard stop current limit	RW	UINT	NO
	0x2203	-	Idle current	RW	UINT	NO
	0x2204	-	Idle current delay time	RW	UINT	NO
	0x2205	-	Acceleration current	RW	UINT	NO
	0x2206	-	Stall prevention time	RW	UINT	NO
	0x2207	-	Steps per rev	RO	UINT	NO
	0x2208	-	Reverse motor direction	RW	UINT	NO
	0x2209	-	Powerup probing	RW	UINT	NO
	0x220B	-	Fault output on Y1	RW	UINT	NO
	0x220C	-	Brake output on Y2	-	-	-
		1	Brake output	RW	UINT	NO
		2	Brake disengage delay	RW	UINT	NO
		3	Brake engage delay	RW	UINT	NO
	0x220D	-	Motion output	-	-	-
		1	Motion output on Y1	RW	UINT	NO
		2	Motion output on Y2	RW	UINT	NO
		3	Motion output on Y3	RW	UINT	NO
		4	Motion output on Y4	RW	UINT	NO
	0x220E	-	Alarm reset on input X6	RW	UINT	NO
	0x220F	-	Define limits	RW	UINT	NO
	0x2210	-	Inputs filter	-	-	-
		1	Inputs filter X1 filter time	RW	UINT	NO
		2	Inputs filter X2 filter time	RW	UINT	NO
	
		8	Inputs filter X8 filter time	RW	UINT	NO
	0x2211	-	Notch filter	-	-	-
		1	Notch filter_paraA	RW	INT	NO
		2	Notch filter_paraB	RW	INT	NO
	
		8	Notch filter_paraH	RW	INT	NO
	0x2212	-	Analog configuration	-	-	-
		1	Analog deadband	RW	UINT	NO
		2	Analog offset vallue	RW	UINT	NO
		3	Analog filter	RW	UINT	NO
		4	Analog threshold	RW	UINT	NO
		5	Analog scaling	RW	UINT	NO
	0x2213	-	Analog auto zero	RW	UINT	NO
	0x2214	-	Operation mode	RW	UINT	NO
0x2215	-	Jog mode	RW	UINT	NO	

	Index	Sub	Name	Access	Type	Mapping
0x2200~ 2300h	0x2216	-	Torque constant	RW	UINT	NO
	0x2218	-	Encoder resolution	RO	UINT	NO
	0x2220	-	Position gain	RW	UINT	NO
	0x2221	-	Positionderi gain	RW	UINT	NO
	0x2222	-	Positionderi filter	RW	UINT	NO
	0x2224	-	Velocity gain	RW	UINT	NO
	0x2225	-	Velocityinterg gain	RW	UINT	NO
	0x2226	-	Accfeedforward	RW	UINT	NO
	0x2227	-	PID filter	RW	UINT	NO
	0x2252	-	Inposition counts	RW	UINT	NO
	0x2253	-	CSP complete time	RW	UINT	NO
	0x2254	-	Inposition error range	RW	UINT	NO
	0x2255	-	Inposition time	RW	UINT	NO
	0x2260	-	Actual current	RO	INT	NO
	0x2261	-	Analog reading	RO	INT	NO
		1	Analog reading value	RO	INT	YES
		2	Analog reading input 1	RO	INT	YES
		3	Analog reading input 2	RO	INT	YES
	0x2262	-	Motor name	RO	STRING(5)	NO
	0x2265	-	E-Stop on input X8	RW	UINT	NO
	0x2270	-	Encoder error	RO	UINT	NO
0x2271	-	Clear Multi-turn	RW	UINT	NO	

0x2200 Continuous current

This object is used to set the continuous (RMS) current of the StepSERVO drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2200	-	Continuous current	RW	UINT	NO	-

0x2201 Peak current

This object is used to set the peak (RMS) current of the StepSERVO drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2201	-	Peak current	RW	UINT	NO	-

0x2202 Hardstop current limit

This object is used for hard stop homing mode that setting the current when the motor hit the hard stop position.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2202	-	Hardstop current limit	RW	UINT	NO	-

0x2203 Idle current

This object configures monitors the motor holding current of the device in idle mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2203	-	Idle current	RW	UINT	NO	-

The value shall be given in mA, If the reading value is 100. That means 1.00Amps.

0x2204 Idle current delay time

This object is used to set the amount of time the drive will delay before transitioning from full current (CC) to idle current(CI).

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2204	-	Idle current delay time	RW	UINT	NO	-

The value shall be given in second, If the reading value is 10. That means 1.0 seconds.

0x2205 Acceleration current

This object shall provide the acceleration current when the motor is running with stepper mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2205	-	Acceleration current	RW	UINT	NO	-

If the reading value is 100 that means 1.00Amps.

0x2206 Stall prevention time

This object is used to set the stall prevention time.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2206	-	Stall prevention time	RW	UINT	NO	-

If the value is 10 means set to 0.1 second.

0x2207 Steps per rev

This object is used to get the steps per revolution about motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2207	-	Step per rev	RO	UINT	NO	-

The value shall be given in steps/rev.

0x2208 Reverse motor direction

This object is used to reverse motor rotating direction.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2208	-	Reverse motor direction	RW	UINT	NO	-

The value can be set to 0 - 1.

Value =0 default rotating direction
 =1 reverse rotating direction

0x2209 Powerup probing

This object is used to set the drive to probe when power up.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2209	-	Powerup probing	RW	UINT	NO	-

Value =0 NO probing
 =1 Probing

0x220B Fault output on Y1

This object is used to set the fault output on Y1.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x220B	-	Fault output on Y1	RW	UINT	NO	-

Value =1 output Y1 is open when the driver is fault
 =2 output Y1 is closed when the driver is fault
 =3 output Y1 is used for general purpose

0x220C Brake output on Y2

This object at 0x220C is used to set the parameter of brake configuration. There has 3 sub-index to configure brake, the first is used for brake output, and the second is used for disengage delay. The last is used to set brake engage delay.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x220C	0	Number of sub-index	RO	USINT8	NO	3
	1	Brake output	RW	UINT	NO	-
	2	Brake disengage delay	RW	UINT	NO	-
	3	Brake engage delay	RW	UINT	NO	-

Brake output:

Value =1 output is closed when drive is enabled, and open when the drive is disabled.
 =2 output is open when drive is enabled, and closed when the drive is disabled.
 =3 output is not used as a brake output and can be used as g general purpose output.

Brake disengage delay and brake engage delay

The units is 1ms, if write 100 to the index means 0.1s.

0x220D Motion output

This object is used to define the drive Motion output function.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x220D	0	Number of sub-index	RO	USINT8	NO	3
	1	Motion output on Y1	RW	UINT	NO	-
	2	Motion output on Y2	RW	UINT	NO	-
	3	Motion output on Y3	RW	UINT	NO	-
	4	Motion output on Y4	RW	UINT	NO	-

They can be set to various functions.

- Value =1 Open when static position error less than in-position counts.
- =2 Closed when static position error less than in-position counts.
- =3 General purpose
- =4 Tach output with 100 pulses/rev
- =5 Tach output with 200 pulses/rev
- =6 Tach output with 400 pulses/rev
- =7 Tach output with 800 pulses/rev
- =8 Tach output with 1600 pulses/rev
- =9 Closed (energized) when dynamic position error is less than set value.
- =10 Open (de-energized) when dynamic position error is less than set value.
- =11 Timing out (50 pulses/rev)

0x220E Alarm reset on input X6

This object is used to set usage of the alarm reset input. Input X6 is the default AR input on MOONS' drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x220E	-	Alarm reset on input X6	RW	UINT	NO	-

- Value =1 input x6 is used for drive alarm reset when open
- =2 input x6 is used for drive alarm reset when closed
- =3 input x6 is used for general purpose

0x220F Define limits

This object is used to set the definition of limit.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x220F	-	Define limits	RW	UINT	NO	-

=0x01	At end of travel, (X3=CW,X4=CCW)will be closed
=0x02	At end of travel, (X3=CW,X4=CCW)will be open
=0x07	At end of travel, X3=CW will be closed, X4=GP
=0x08	At end of travel, X3=CW will be open, X4=GP
=0x09	At end of travel, X4=CCW will be closed, X3=GP
=0x0A	At end of travel, X4=CCW will be open, X3=GP
=0x0B	At end of travel, (X3=CCW,X4=CW)will be closed
=0x0C	At end of travel, (X3=CCW,X4=CW)will be open
=0x11	At end of travel, X3=CCW will be closed, X4=GP
=0x12	At end of travel, X3=CCW will be open, X4=GP
=0x13	At end of travel, X4=CW will be closed, X3=GP
=0x14	At end of travel, X4=CW will be open, X3=GP
=0x15	At end of travel, (X3=CW,X4=CCW)will be closed[No Alarm]
=0x16	At end of travel, (X3=CW,X4=CCW)will be open[No Alarm]
=0x1B	At end of travel, X3=CW will be closed, X4=GP[No Alarm]
=0x1C	At end of travel, X3=CW will be open, X4=GP[No Alarm]
=0x1D	At end of travel, X4=CCW will be closed, X3=GP[No Alarm]
=0x1E	At end of travel, X4=CCW will be open, X3=GP[No Alarm]
=0x1F	At end of travel, (X3=CCW,X4=CW)will be closed[No Alarm]
=0x20	At end of travel, (X3=CCW,X4=CW)will be open[No Alarm]
=0x25	At end of travel, X3=CCW will be closed, X4=GP[No Alarm]
=0x26	At end of travel, X3=CCW will be open, X4=GP[No Alarm]
=0x27	At end of travel, X4=CW will be closed, X3=GP[No Alarm]
=0x28	At end of travel, X4=CW will be open, X3=GP[No Alarm]

0x2210 Input filter

This object is used to set a digital filter to the input.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2210	0	Number of sub-index	RO	USINT8	NO	8
	1	Input X1 filter time	RW	UINT	NO	-
	2	Input X2 filter time	RW	UINT	NO	-
	3	Input X3 filter time	RW	UINT	NO	-
	4	Input X4 filter time	RW	UINT	NO	-
	5	Input X5 filter time	RW	UINT	NO	-
	6	Input X6 filter time	RW	UINT	NO	-
	7	Input X7 filter time	RW	UINT	NO	-
	8	Input X8 filter time	RW	UINT	NO	-

The unit of this parameter is 200us. If the value you set to 100, means 20ms delay.

0x2211 Notch filter

These eight objects shall configure the Notch Filter parameters in torque mode. This object is only available on StepSERVO drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2211	0	Number of sub-index	RO	USINT8	NO	8
	1	Notch filter_paraA	RW	INT	NO	-
	2	Notch filter_paraB	RW	INT	NO	-
	3	Notch filter_paraC	RW	INT	NO	-
	4	Notch filter_paraD	RW	INT	NO	-
	5	Notch filter_paraE	RW	INT	NO	-
	6	Notch filter_paraF	RW	INT	NO	-
	7	Notch filter_paraG	RW	INT	NO	-
	8	Notch filter_paraH	RW	INT	NO	-

0x2212 Analog configuration

This object shall indicate the configuration of running mode about analog. We should set the value of this object when running with analog velocity/position/torque mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2212	0	Number of sub-index	RO	USINT8	NO	5
	1	Analog deadband	RW	UINT	NO	-
	2	Analog offset value	RW	UINT	NO	-
	3	Analog filter	RW	UINT	NO	-
	4	Analog threshold	RW	UINT	NO	-
	5	Analog scaling	RW	UINT	NO	-

Analog deadband

The unit is in 0.001volt

Analog offset value

The unit is in 0.001volt

Analog filter

Filter value = $72090 / [(1400 / x) + 2.2]$. Where x = desired value of the analog filter in Hz

Analog threshold

Sets or requests the Analog Input Threshold that is used by the “Feed to Sensor” command. The threshold value sets the Analog voltage that determines a sensor state or a trigger value.

Analog scaling

Value =0	single-ended +/- 10 volts
=1	single-ended 0 - 10 volts
=2	single-ended +/- 5 volts
=3	single-ended 0 - 5 volts
=4	differential +/- 10 volts
=5	differential 0 - 10 volts
=6	differential +/- 5 volts
=7	differential 0 - 5 volts

0x2213 Analog auto zero

This object is used to set the current analog to zero, the value can be set to 1.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2213	-	Analog auto zero	RW	UINT	NO	-

0x2214 Operation mode

This object is used to set the power-up mode of the drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2214	-	Operation mode	RW	UINT	NO	-

Value =1	Si program
=2	Q/SCL(drive enabled)
=3	Quick tuner(servos) or Configurator(stepipers)
=4	SiNET Hub
=5	Q/SCL(drive disabled)
=6	not used
=7	Q program, auto-execute

0x2215 Jog mode

This object is used to set the jog mode. There has two mode for MOONS' drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2215	-	Jog mode	RW	UINT	NO	-

Value =1	position-type servo control when jogging
=2	velocity-type servo control when jogging

0x2216 Torque constant

This object shall configure the motor's torque constant in manufacturer specific units. The units should be m Nm/Amps.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2216	-	Torque constant	RW	UINT	NO	-

This object only supported in StepSERVO drives.

0x2218 Encoder resolution

This object shall provide the encoder configuration of the motor. It contains how many counts per revolution.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2218	-	Encoder resolution	RO	UINT	NO	-

0x2220 Position gain

This object shall configure the proportional Gain in Position loop to StepSERVO drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2220	-	Position gain	RW	UINT	NO	-

0x2221 Position derigain

This object shall configure the Derivative Gain in Position loop to StepSERVO drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2221	-	Positionderi gain	RW	UINT	NO	-

0x2222 Position derifilter

This object provides a very simple single-pole low pass filter that is used to limit this high frequency noise and make the system quieter and more stable.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2222	-	Positionderi filter	RW	UINT	NO	-

0x2224 Velocity gain

This object shall configure the proportional Gain in Velocity loop to StepSERVO drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2224	-	Velocity gain	RW	UINT	NO	-

0x2225 Velocityinteg gain

This object shall configure the Integral Gain in Velocity loop to StepSERVO drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2225	-	Velocityinteg gain	RW	UINT	NO	-

0x2226 Accfeedforward

This object shall configure to add a feed forward acceleration/deceleration to the torque command to faster the system's response.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2226	-	Accfeedforward	RW	UINT	NO	-

0x2227 PID filter

This object provide a torque command over-all filter at the end of Velocity loop. The filter is a very simple single-pole low pass filter that is used to limit the high frequency response of the Velocity and therefore the Position control loops.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2227	-	PID filter	RW	UINT	NO	-

0x2252 Inposition counts

This object is used to set static in-position error range.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2252	-	Inposition counts	RW	UINT	NO	-

0x2253 CSP complete time

This object is used to set the delay time that the motor is in completion of rotating with CSP mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2253	-	CSP complete time	RW	UINT	NO	-

The units is 0.001 second.

0x2254 In position error range

This object is used to set static in-position error range. When the actual position is within the target In position error range for a time duration that exceeds the PE specified timing, then the driver will define the motion complete or motor in-position.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2254	-	In position error range	RW	UINT	NO	-

0x2255 In position time

This object is used to set the time duration for in range determination. For example, when In position error PD is defined, PE will set the time duration for in-position test condition. The drive defines the motor as in position when the actual position is within the target position range (PD) for the defined minimum time (PE).

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2255	-	In position time	RW	UINT	NO	-

0x2260 Actual current

This object shall provide the current of the motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2260	-	Actual current	RO	INT	NO	-

0x2261 Analog reading

This object shall provide the analog value of drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2261	0	Number of sub-index	RO	USINT8	NO	3
	1	Analog reading	RW	INT	YES	-
	2	Analog reading input 1	RW	INT	YES	-
	3	Analog reading inupt 2	RW	INT	YES	-

0x2262 Motor name

This object shall provide the name of the motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2262	-	Motor	RO	STRING(15)	NO	-

0x2265 E-Stop on input X8

This object is used to set the E-Stop function on input X8.

Index	Sub	Name	Access type	Date type	PDO mapping	Default value
0x2265	-	E-Stop on input X8	RW	UINT	NO	0

Value =1	Emergency stop when closed(fault)
=2	Emergency stop when open(fault)
=3	General purpose/Touch probe2
=5	Emergency stop when closed(warning)
=6	Emergency stop when open(warning)
=7	Emergency stop when closed(auto clear alarm)
=8	Emergency stop when open(auto clear alarm)

0x2270 Encoder error

This object shall provide the error of encoder for absolute encoder stepper motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2270	-	Encoder error	RO	UINT	NO	-

0X2271 Clear multi-turn

This object is used to clear the multi-turn position of absolute encoder motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2271	-	Clear multi-turn	RW	UINT	NO	-

4.6 Manufacturer parameter for Stepper

	Index	Sub	Name	Access	Type	mapping
0x2600~ 2700	0x2600	-	Running current	RW	UINT	NO
	0x2601	-	Idle current	RW	UINT	NO
	0x2602	-	Idle current delya time	RW	UINT	NO
	0x2603	-	Acceleration current	RW	UINT	NO
	0x2604	-	Steps per rev	RW	UINT	NO
	0x2605	-	Reverse motor direction	RW	UINT	NO
	0x2606	-	Fault output on Y1	RW	UINT	NO
	0x2607	-	Brake output on Y2	-	-	-
		-	Brake output	RW	UINT	NO
		-	Brake disengage delay	RW	UINT	NO
		-	Brake engage delay	RW	UINT	NO
	0x2608	-	Motion output	-	-	-
		-	MO on output Y1	RW	UINT	NO
		-	MO on output Y2	RW	UINT	NO
		-	MO on output Y3	RW	UINT	NO
		-	MO on output y4	RW	UINT	NO
	0x2609	-	Alarm reset on input X6	RW	UINT	NO
	0x260B	-	Define limits	RW	UINT	NO
	0x260C	-	Inputs filter	-	-	-
		-	Inputs X1 filter time	RW	UINT	NO
		-	Inputs X2 filter time	RW	UINT	NO
		-
		-	Inputs X8 filter time	RW	UINT	NO
	0x260D	-	Dynamic open winding detection	RW	UINT	NO
	0x260E	-	Open winding detect speed limit	RW	UDINT	NO
	0x260F	-	Powerup open winding detection	RW	UINT	NO
	0x2610	-	Motor model number	RW	UINT	NO
	0x2611	-	Load ratio	RW	UINT	NO
	0x2612	-	Third party motor parameters	-	ARRAY	NO
		1	MotorName 1	RW	UDINT	NO
		2	MotorName 2	RW	UDINT	NO
		3	MotorName 3	RW	UDINT	NO
		4	MotorName 4	RW	UDINT	NO
5		MotorPara_01	RW	UINT	NO	
6		MotorPara_01	RW	UINT	NO	
...		
12		MotorPara_14	RW	UINT	NO	
13		Reserved_01	RW	UINT	NO	
14		Reserved_02	RW	UINT	NO	
...		
18		Reserved_06	RW	UINT	NO	
0x2615		-	StepInputs counts	RO	DINT	NO

	Index	Sub	Name	Access	Type	Mapping
0x2600~ 2700h	0x2617	-	E-stop on input X8	RW	UINT	NO
	0x2618	-	Waveform smoothing	-	-	-
		1	Harmonic gain	RW	UINT	NO
		2	Harmonic	RW	INT	NO
	0x2619	-	Current coeff	RW	UINT	NO
	0x26D5	-	Touch probe 1 pos edge counter	RW	UINT	NO
	0x26D6	-	Touch probe 1 neg edge counter	RW	UINT	NO
	0x26D7	-	Touch probe 2 pos edge counter	RW	UINT	NO
	0x26D8	-	Touch probe 2 neg edge counter	RW	UINT	NO

0x2600 Running current

This object is used to set the continuous (RMS) current of the Stepper drives.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2600	-	Running current	RW	UINT	NO	-

0x2601 Idle current

This object configures monitors the motor holding current of the device in idle mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2601	-	Idle current	RW	UINT	NO	-

If the reading value is 100. That means 1.00Amps.

0x2602 Idle current delay time

This object is used to set the amount of time the drive will delay before transitioning from full current (CC) to idle current(CI).

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2602	-	Idle current delay time	RW	UINT	NO	-

If the reading value is 10. That means 1.0 seconds.

0x2603 Acceleration current

This object shall provide the acceleration current when the motor is running with stepper mode.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2603	-	Acceleration current	RW	UINT	NO	-

If the reading value is 100 that means 1.00Amps.

0x2604 Steps per rev

This object is used to get the steps per revolution about motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2604	-	Step per rev	RW	UINT	NO	-

The value shall be given in steps/rev.

0x2605 Reverse motor direction

This object is used to reverse motor rotating direction.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2605	-	Reverse motor direction	RW	UINT	NO	-

The value can be set to 0 - 1.

Value =0 default rotating direction
 =1 reverse rotating direction

0x2606 Fault output on Y1

This object is used to set the fault output on Y1.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2606	-	Fault output on Y1	RW	UINT	NO	-

Value =1 output Y1 is open when the driver is fault
 =2 output Y1 is closed when the driver is fault
 =3 output Y1 is used for general purpose

0x2607 Brake output on Y2

This object at 0x2607 is used to set the parameter of brake configuration. There has 3 sub-index to configure brake, the first is used for brake output, and the second is used for disengage delay. The last is used to set brake engage delay.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2607	0	Number of sub-index	RO	USINT8	NO	3
	1	Brake output	RW	UINT	NO	-
	2	Brake disengage delay	RW	UINT	NO	-
	3	Brake engage delay	RW	UINT	NO	-

Brake output:

Value =1 output is closed when drive is enabled, and open when the drive is disabled.
 =2 output is open when drive is enabled, and closed when the drive is disabled.
 =3 output is not used as a brake output and can be used as g general purpose output.

Brake disengage delay and brake engage delay

The units is 1ms, if write 100 to the index means 0.1s.X

0x2608 Motion output

This object is used to define the drive Motion output function.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2608	0	Number of sub-index	RO	USINT8	NO	3
	1	Motion output on Y1	RW	UINT	NO	-
	2	Motion output on Y2	RW	UINT	NO	-
	3	Motion output on Y3	RW	UINT	NO	-
	4	Motion output on Y4	RW	UINT	NO	-

- Value =1 Open when static position error less than in-position counts.
- =2 Closed when static position error less than in-position counts.
- =3 General purpose (fault output or brake output)
- =4 Tach output with 100 pulses/rev
- =5 Tach output with 200 pulses/rev
- =6 Tach output with 400 pulses/rev
- =7 Tach output with 800 pulses/rev
- =8 Tach output with 1600 pulses/rev
- =9 Closed (energized) when dynamic position error is less than set value.
- =10 Open (de-energized) when dynamic position error is less than set value.
- =11 Timing out (50 pulses/rev)

0x2609 Alarm reset on input X6

This object is used to set usage of the alarm reset input. Input X6 is the default AR function on MOONS' drive.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2609	-	Alarm reset on input X6	RW	UINT	NO	-

- Value =1 input x6 is used for drive alarm reset when open
- =2 input x6 is used for drive alarm reset when closed
- =3 input x6 is used for general purpose

0x260B Define limits

This object is used to set the definition of limit.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x260B	-	Alarm reset on input X6	RW	UINT	NO	-

Value =0x01	At end of travel, (X3=CW,X4=CCW)will be closed
=0x02	At end of travel, (X3=CW,X4=CCW)will be open
=0x07	At end of travel, X3=CW will be closed, X4=GP
=0x08	At end of travel, X3=CW will be open, X4=GP
=0x09	At end of travel, X4=CCW will be closed, X3=GP
=0x0A	At end of travel, X4=CCW will be open, X3=GP
=0x0B	At end of travel, (X3=CCW,X4=CW)will be closed
=0x0C	At end of travel, (X3=CCW,X4=CW)will be open
=0x11	At end of travel, X3=CCW will be closed, X4=GP
=0x12	At end of travel, X3=CCW will be open, X4=GP
=0x13	At end of travel, X4=CW will be closed, X3=GP
=0x14	At end of travel, X4=CW will be open, X3=GP
=0x15	At end of travel, (X3=CW,X4=CCW)will be closed[No Alarm]
=0x16	At end of travel, (X3=CW,X4=CCW)will be open[No Alarm]
=0x1B	At end of travel, X3=CW will be closed, X4=GP[No Alarm]
=0x1C	At end of travel, X3=CW will be open, X4=GP[No Alarm]
=0x1D	At end of travel, X4=CCW will be closed, X3=GP[No Alarm]
=0x1E	At end of travel, X4=CCW will be open, X3=GP[No Alarm]
=0x1F	At end of travel, (X3=CCW,X4=CW)will be closed[No Alarm]
=0x20	At end of travel, (X3=CCW,X4=CW)will be open[No Alarm]
=0x25	At end of travel, X3=CCW will be closed, X4=GP[No Alarm]
=0x26	At end of travel, X3=CCW will be open, X4=GP[No Alarm]
=0x27	At end of travel, X4=CW will be closed, X3=GP[No Alarm]
=0x28	At end of travel, X4=CW will be open, X3=GP[No Alarm]

0x260C Inputs filter

This object is used to set a digital filter to the input.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2210	0	Number of sub-index	RO	USINT8	NO	8
	1	Input X1 filter time	RW	UINT	NO	-
	2	Input X2 filter time	RW	UINT	NO	-
	3	Input X3 filter time	RW	UINT	NO	-
	4	Input X4 filter time	RW	UINT	NO	-
	5	Input X5 filter time	RW	UINT	NO	-
	6	Input X6 filter time	RW	UINT	NO	-
	7	Input X7 filter time	RW	UINT	NO	-
	8	Input X8 filter time	RW	UINT	NO	-

The unit of this parameter is 200us. If the value you set to 100, means 20ms delay.

0x260D Dynamic open winding detection

This object is used to set the function of Dynamic open winding detection.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x260D	-	Dynamic open winding detection	RW	UINT	NO	-

Value =0	disable
=1	enable

0x260E Open winding detection speed limit

This object is used to set the velocity limit of the open winding status detect when the motor is moving.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x260E	-	Open winding detection speed limit	RW	UDINT	NO	-

The unit of this object is counts/s.

0x260F Powerup open winding detection

This object is used to configurate the detection of open winding when power up.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x260F	-	Powerup open winding detection	RW	UINT	NO	-

0x2610 Motor model number

This object provide the model number of motor.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2610	-	Motor model number	RW	UINT	NO	-

0x2611 Load ratio

This object sets the ratio of the load inertia to the rotor inertia.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2611	-	Load ratio	RW	UINT	NO	-

- Value =1 1x rotor inertia
- =2 1x-3x rotor inertia
- =3 3x-5x rotor inertia
- =4 5x-7x rotor inertia
- =5 7x-10x rotor inertia

0x2612 Third party motor parameters

This object shall indicate the motor of custom.

Index	Sub	Name	Access Type	Data Type	PDO mapping	-Default Value-
0x2612	0	Number of sub-index	RO	USINT8	NO	25
	1	MotorName_1	RW	UDINT	NO	-
	2	MotorName_2	RW	UDINT	NO	-
	3	MotorName_3	RW	UDINT	NO	-
	4	MotorName_4	RW	UDINT	NO	-
	5	MotorPara_1	RW	UINT	NO	-
	6	MotorPara_2	RW	UINT	NO	-
	7	MotorPara_3	RW	UINT	NO	-
	8	MotorPara_4	RW	UINT	NO	-
	9	MotorPara_5	RW	UINT	NO	-
	A	MotorPara_6	RW	UINT	NO	-
	B	MotorPara_7	RW	UINT	NO	-
	C	MotorPara_8	RW	UINT	NO	-
	D	MotorPara_9	RW	UINT	NO	-
	E	MotorPara_10	RW	UINT	NO	-
	F	MotorPara_11	RW	UINT	NO	-
	10	MotorPara_12	RW	UINT	NO	-
	11	MotorPara_13	RW	UINT	NO	-
	12	MotorPara_14	RW	UINT	NO	-
13	Reseverd_01	RW	UINT	NO	-	
14	Reseverd_02	RW	UINT	NO	--	
15	Reseverd_03	RW	UINT	NO	-	
16	Reseverd_04	RW	UINT	NO	-	
17	Reseverd_05	RW	UINT	NO	-	
18	Reseverd_06	RW	UINT	NO	-	

0x2615 StepInputs counts

This object provide the pulse counter coming into the X1/STEP and X2/DIR input of the drive.

Index	Sub	Name	Access type	Date type	PDO mapping	Default value
0x2615	-	StepInputs counts	RO	DINT	YES	0

0x2617 E-stop on input X8

This object is used to set usage of the E-stop input.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2617	-	E-stop on input X8	RW	UINT	NO	-

Value =1	Emergency stop when closed(fault)
=2	Emergency stop when open(fault)
=3	General purpose/Touch probe2
=5	Emergency stop when closed(warning)
=6	Emergency stop when open(warning)
=7	Emergency stop when closed(auto clear alarm)
=8	Emergency stop when open(auto clear alarm)

0x2618 Waveform smoothing

This object is used to set the 4th harmonic filter gain/phase setting.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2618	0	Number of sub-index	RO	USINT8	NO	2
	1	Harmonic gain	RW	UINT	NO	-
	2	Harmonic phase	RW	UINT	NO	-

0x2619 Current coeff

This object shall indicate the value of current coefficient, the value should be given per hundred of rated current.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x2619	-	Current coeff	RW	UINT	NO	-

0x26D5 Touch probe 1 pos edge counter

This object shall provide the position value of the touch probe 1 at positive edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x26D5	-	Touch probe 1 pos edge counter	RO	UINT	YES	-

0x26D6 Touch probe 1 neg edge counter

This object shall provide the position value of the touch probe 1 at negative edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x26D6	-	Touch probe 1 pos edge counter	RO	UINT	YES	-

0x26D7 Touch probe 2 pos edge counter

This object shall provide the position value of the touch probe 2 at positive edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x26D7	-	Touch probe 1 pos edge counter	RO	UINT	YES	-

0x26D8 Touch probe 2 neg edge counter

This object shall provide the position value of the touch probe 2 at negative edge.

Index	Sub	Name	Access Type	Data Type	PDO mapping	Default Value
0x26D8	-	Touch probe 1 pos edge counter	RO	UINT	YES	-

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