

Motion Drive

Digital drive for Brushless motors SMD Series

Communication Manual

Read manual before installing and follow all instructions with this icon:



Serad SMD

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I. Introduction

I.1 Drive Studio

I.1.1 General:

The Drive Studio, with its graphical user interface, allows the user to easily configure the drive from a PC. Operating within a Windows environment, the user-friendly software provides for multiple windows and full help facilities.

The auto tuning, trajectory generator and oscilloscope functions ensure speedy and optimum system set-up and rapid commissioning.

I.1.2 Technical data:

- ↳ Configuration of all parameters, grouped by function: motor, regulation, encoder, analogue I/O, digital I/O, communication, supervision
- ↳ Downloading of set-up and parameters: speed, current, torque, position
- ↳ Saving and printing all parameters on a PC
- ↳ Automatic resolver offset adjustment
- ↳ Trajectory generator: position, acceleration, deceleration, speed
- ↳ Digital multi-channel oscilloscope
- ↳ Set-up screen: axis, inputs, outputs
- ↳ Automatic recognition of connected drive
- ↳ Ability to work and edit parameters without being connected to a drive
- ↳ On-line help for each window

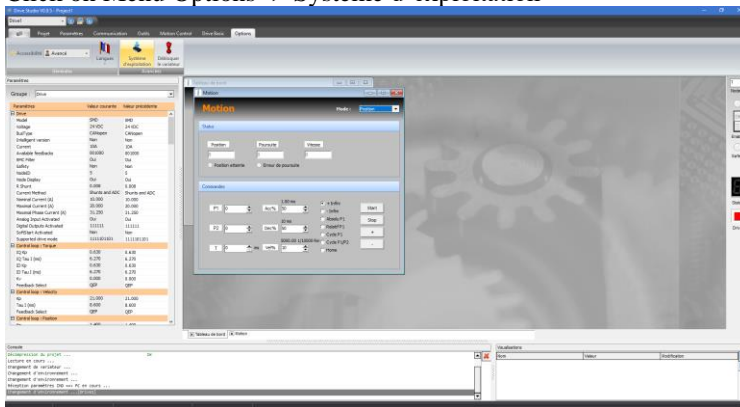
I.1.3 Drive Basic: programming language

The SMD series drives incorporate a real-time, multi-tasking kernel and have more than 1000 user variables. The pseudo-basic language, Drive Basic, allows users to develop, test and save their own application programs. These applications can use any combination of operating modes e.g. torque, speed and position. All of the I/O can be controlled from within the program as well as parameters and variables.

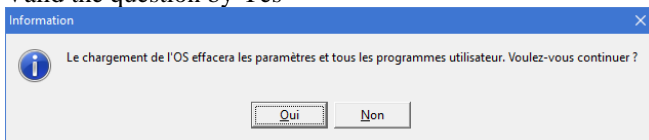
I.1.4 Update SMD Operating System

To update the SMD Operating System, follow these states:

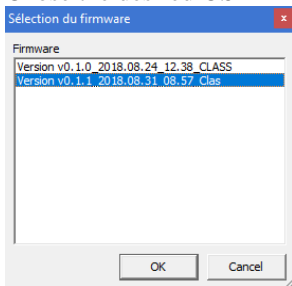
1. Click on Menu Options -> Système d'exploitation



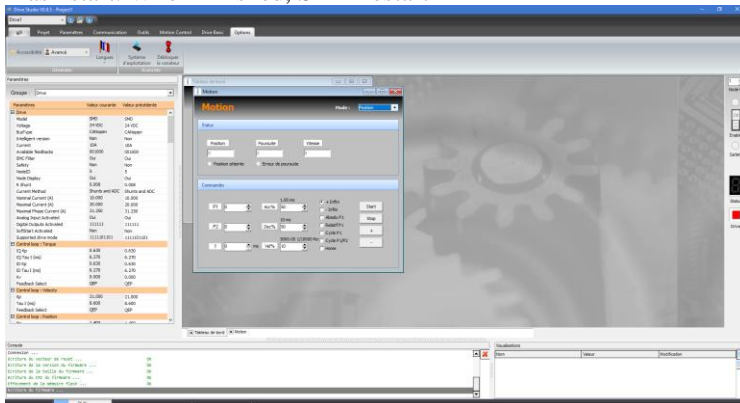
2. Valid the question by Yes



3. Chose the desired OS



4. Flash start. When finished, SMD restart



I.1.5 Boot Forced mode

The boot force mode allows to the SMD to wait indefinitely a new software via USB/Serial port.

This can be use if internal flash was corrupted and not allow the OS to dialog with the computer and the external flash was empty (where a copy of the OS should be present).

Furthermore, this will force to restore the factory parameters according to the new OS firmware loaded.

1. Place all DIP to ON
2. Power On the SMD (Display will blink “b”, Led COM Rx/Tx will blink)
3. Update firmware with DriveStudio
4. Power Off the SMD
5. Place Dips according your configuration
6. Power ON the SMD. It will start with the new OS. Factory parameter will all be restored.

II. Communication

According SMD version, the communication can be done via

- CANopen bus
- EtherCAT CoE bus
- USB/Serial Modbus

The communication is based on:

- The standard CiA 301 version 4.2.0 of 21 February 2011: “CANopen application layer and communication profile”
- The standard BS EN 61800-7-201:2016 which is equivalent to CiA 402: “Device profile for Drives and Motion Control”
- For EtherCAT, ETG.6010 D ® V1.1.0: “Implementation Directive for CiA402 Drive Profile. Directive for using 61800-7-201 within EtherCAT-based servo drives.

II.1 CAN configuration

The following options exist for configuring the drive:

- CANOpen Node-ID (Hardware: Refer to Installation Guide)
- Terminating resistor (Hardware: Refer to Installation Guide)
- Baud rate (Software)

II.1.1 Baud rate

The baud rate is configurable by the object dictionary 0x2201:

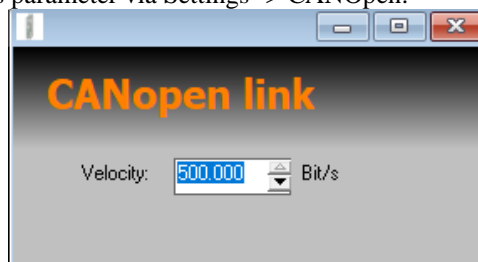
Object description	
Attribute	Value
Index	0x2201
Name	CAN Speed (Only for CAN version)
Object Code	VAR
Data Type	Unsigned32
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	CAN Speed
Entry Category	Mandatory
Access	rw
PDO Mapping	None
Value Range	{10000, 20000, 50000, 125000, 250000, 500000, 800000, 1000000}
Default Value	500000

CAN Speed:

CAN baud rate in “bit per second”. Value is only taken on Power ON. Then if value is modified, the drive must be restarted to taken the new speed communication parameter.

Into DriveStudio you can change this parameter via Settings -> CANOpen:



Or directly into Parameters:

Speed Step (%)	1.0	1.0
Communication : CANopen		
Speed (Kbps)	500.000	500.000
Communication : Ethernet		

II.1.2 CAN communication layer concepts

The concept is based on “Object” which is identified by its Index and SubIndex. These objects are stored in a dictionary:

General communication objects

Object dictionary (OD)

Overview

Index range	Description
000 _n	Reserved
0001 _n to 025F _n	Data types
0260 _n to 0FFF _n	Reserved
1000 _n to 1FFF _n	Communication profile area
2000 _n to 5FFF _n	Manufacturer-specific profile area
6000 _n to 9FFF _n	Standardized profile area
A000 _n to AFFF _n	Network variables
B000 _n to BFFF _n	System variables
C000 _n to FFFF _n	Reserved

Communication profile area

Index range	Description
1000 _n to 1029 _n	General communication objects
1200 _n to 12FF _n	SDO parameter objects
1300 _n to 13FF _n	CANopen safety objects
1400 _n to 1BFF _n	PDO parameter objects
1F00 _n to 1F11 _n	SDO manager objects
1F20 _n to 1F27 _n	Configuration manager objects
1F50 _n to 1F54 _n	Program control objects
1F80 _n to 1F89 _n	NMT master objects

Index	Object	Name
1000 _n	VAR	Device type
1001 _n	VAR	Error register
1002 _n	VAR	Manufacturer status register
1003 _n	ARRAY	Pre-defined error field
1005 _n	VAR	COB-ID Sync message
1006 _n	VAR	Communication cycle period
1007 _n	VAR	Synchronous window length
1008 _n	VAR	Manufacturer device name
1009 _n	VAR	Manufacturer hardware version
100A _n	VAR	Manufacturer software version
100C _n	VAR	Guard time
100D _n	VAR	Life time factor
1010 _n	VAR	Store parameters
1011 _n	VAR	Restore default parameters
1012 _n	VAR	COB-ID time stamp
1013 _n	VAR	High resolution time stamp
1014 _n	VAR	COB-ID emergency
1015 _n	VAR	Inhibit time emergency
1016 _n	ARRAY	Consumer heartbeat time
1017 _n	VAR	Producer heartbeat time
1018 _n	RECORD	Identity object
1019 _n	VAR	Sync. counter overflow value
1020 _n	ARRAY	Verify configuration
1021 _n	VAR	Store EDS
1022 _n	VAR	Storage format
1023 _n	RECORD	OS command
1024 _n	VAR	OS command mode
1025 _n	RECORD	OS debugger interface
1026 _n	ARRAY	OS prompt
1027 _n	ARRAY	Module list
1028 _n	ARRAY	Emergency consumer
1029 _n	ARRAY	Error behavior

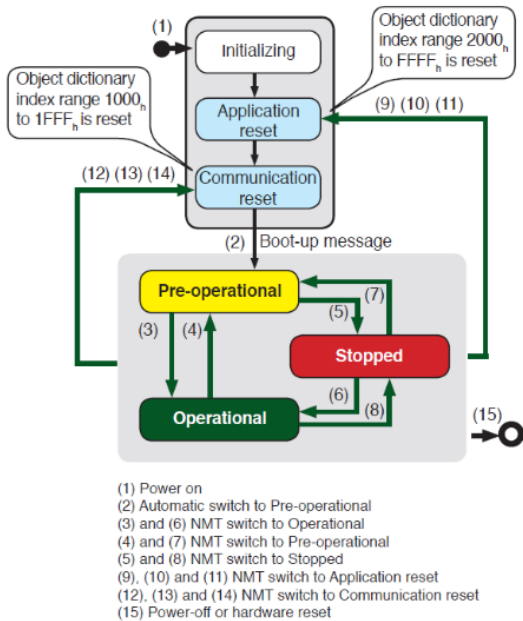
User can access to these objects via two ways:

- Service data object (SDO)
- Process data object (PDO)

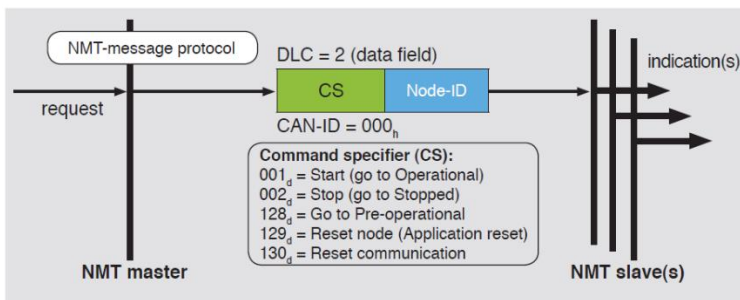
A network management controlled by a defined state machine allow to control the communication. Special function protocols add the notion of synchronization, Time-Stamp and Emergency.

II.1.2.1 Network Management (NMT)

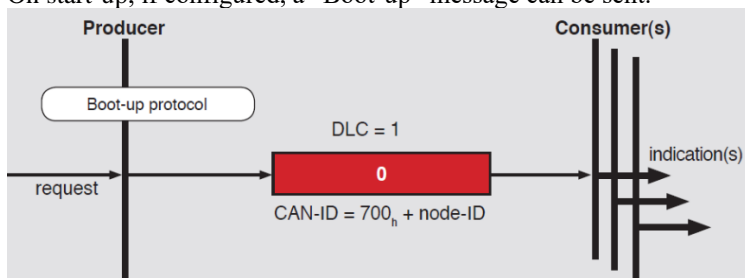
The network management apply the following state machine:



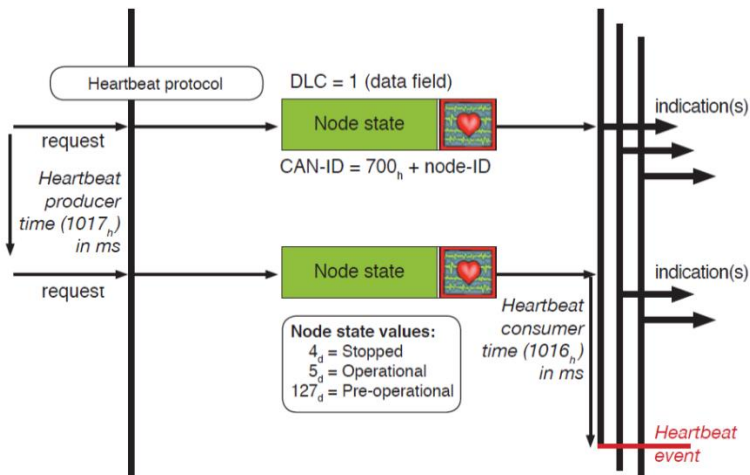
User can control it with the NMT message protocol:



On start-up, if configured, a “Boot-up” message can be sent:

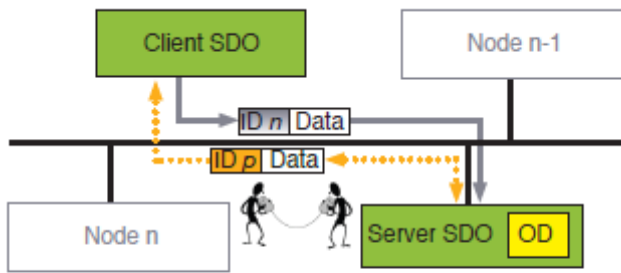


If configured, to ensure do not have problem on communication link, the heartbeat protocol can be used (as producer and/or consumer):

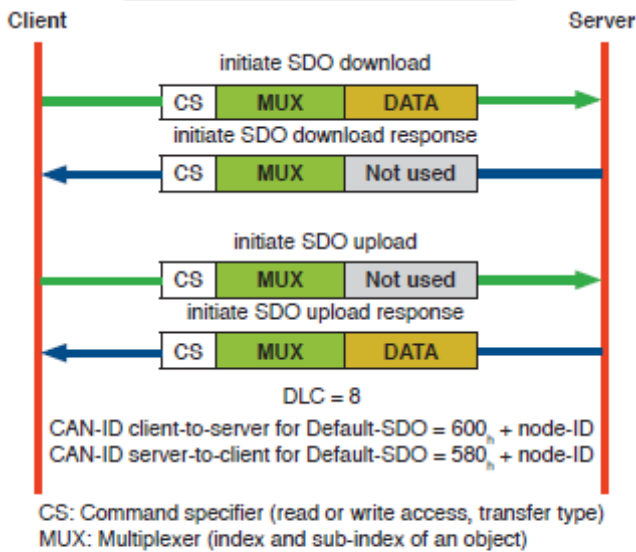


II.1.2.2 Service data object (SDO)

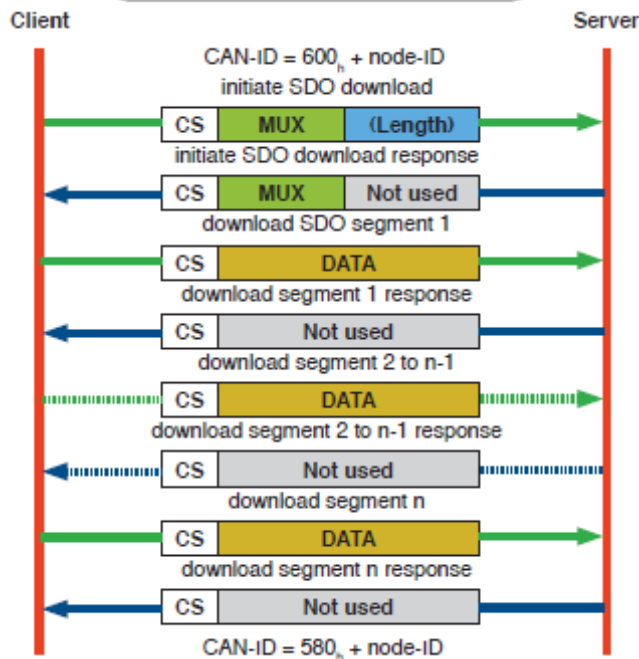
The SDO is used to Read/Write the value of object's SubIndex. It is assuming the drive is the Server SDO:



Expedited SDO protocol



Normal SDO protocol



II.1.2.3 Process data object (PDO)

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

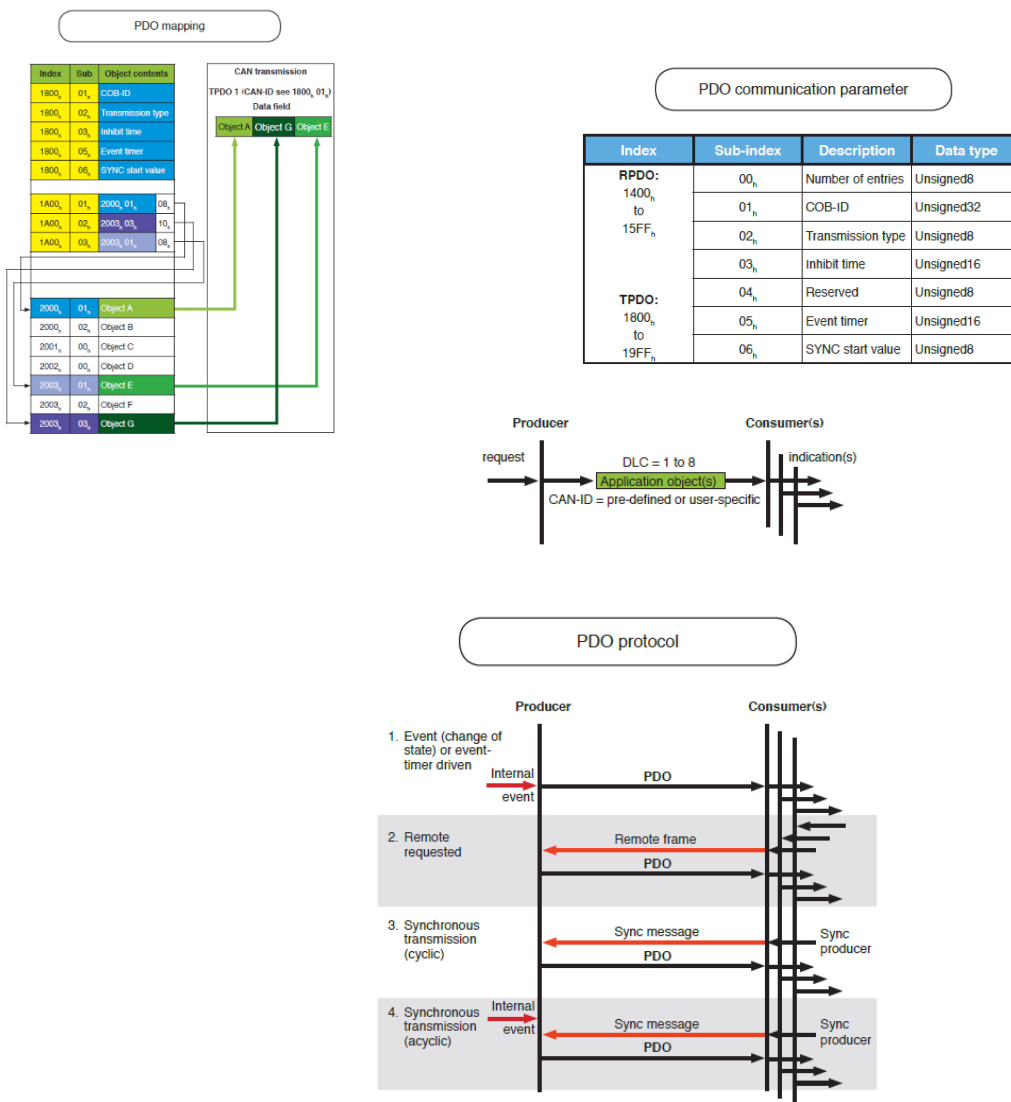
The PDO correspond to objects in the object dictionary and provide the interface to the application objects. Data type and mapping of application objects into a PDO is determined by a corresponding default PDO mapping structure within the object dictionary.

There are two kinds of use for PDO. The first is data transmission and the second data reception. It is distinguished in Transmit-PDO (TPDO) and Receive-PDO (RPDO). CANopen devices supporting TPDO are PDO producer and CANopen devices supporting RPDO are called PDO consumer.

The PDO communication parameter describes the communication capabilities of the PDO.

The PDO mapping parameter contains information about the contents of the PDO.

For each PDO the pair of communication and mapping parameter is mandatory. The objects introduced above are described above.



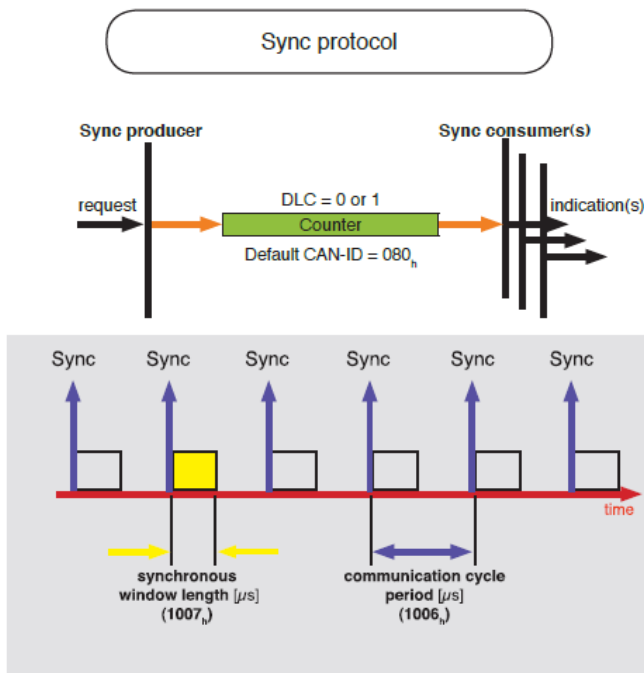
II.1.2.4 Special protocols

Sync protocol

The SYNC producer broadcasts the synchronization object periodically. This SYNC provides the basic network synchronization mechanism. The time period between the SYNCs is specified by the standard parameter communication cycle period, which may be written by a configuration tool to the drive devices during the boot-up process. There may be a time jitter in transmission by the SYNC producer corresponding approximately to the latency due to some other message being transmitted just before the SYNC. The SYNC consumer may use the communication cycle period manufacturer specific.

The optional parameter counter is used to define an explicit relationship between the current SYNC cycle and PDO transmission.

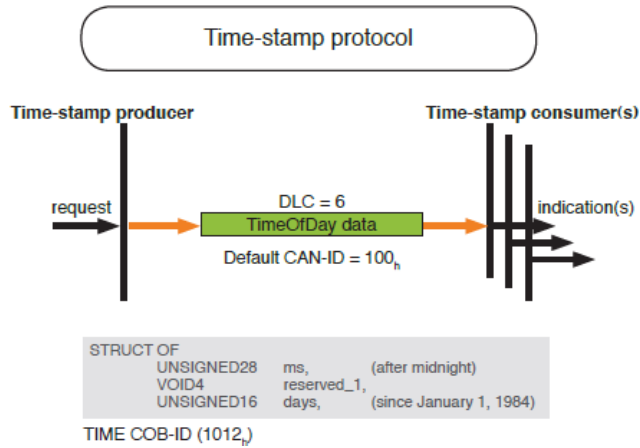
In order to guarantee timely access to the network the SYNC is given a very high priority CAN-ID Drive that operate synchronously may use the SYNC object to synchronize their own timing with that of the synchronization object producer.



Time-stamp protocol

The TIME producer broadcasts the time stamp object. This TIME provides the simple network clock. There may be a time jitter in transmission by the TIME producer corresponding approximately to the latency due to some other message being transmitted just before the TIME.

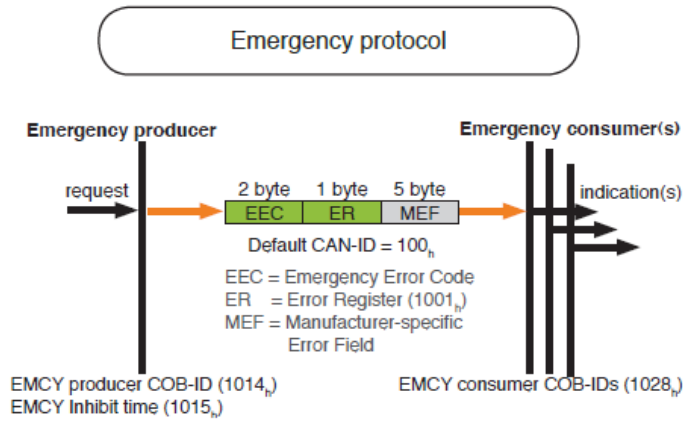
In order to guarantee timely access to the network the TIME is given a very high priority CAN-ID. Drive devices that operate a local clock may use the TIME object to adjust their own time base to that of the time stamp object producer.



Emergency protocol

Emergency objects are triggered by the occurrence of a Drive device internal error situation and are transmitted from an emergency producer on the CANopen device. Emergency objects are suitable for interrupt type error alerts. An emergency object is transmitted only once per 'error event'. No further emergency objects shall be transmitted as long as no new errors occur on a Drive device.

Zero or more emergency consumers may receive the emergency object. The reaction on the emergency consumer(s) specific.



Emergency error codes

00xx _h	Error reset or no error	60xx _h	Device software
10xx _h	Generic error	61xx _h	internal
20xx _h	Current	62xx _h	user
21xx _h		63xx _h	data set
22xx _h		70xx _h	Additional modules
23xx _h	device output side	80xx _h	Monitoring
30xx _h	Voltage	81xx _h	communication
31xx _h		8110 _h	CAN overrun
32xx _h		8120 _h	Error Passive (EP)
33xx _h		8130 _h	Life Guard Error
40xx _h	Temperature	8140 _h	recovered from Bus-off
41xx _h		82xx _h	Protocol error
42xx _h	device	8210 _h	PDO not processed
50xx _h	Device hardware	8220 _h	length exceeded
		90xx _h	External error
		F0xx _h	Additional functions
		FFxx _h	Device-specific

II.2 Ethernet configuration (ProfNet, EthernetIP, Modbus TCP...)

To run correctly, user can configure some Ethernet parameters.

The IP Address/Mask/Gateway. And if DHCP is used to define the IP Address.

If IP address ended by 255 (xxx.xxx.xxx.255) then it is the Node ID defined by the DIP switch which is taken.

Object description	
Attribute	Value
Index	0x2205
Name	Ethernet Parameters (Only for ENET version)
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	Enable DHCP
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	FALSE
Value Range	0x02
Description	IP Address
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	192.168.1.1
Value Range	0x03
Description	SubNetMask
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	255.255.255.0
Value Range	0x04
Description	Gateway
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	0.0.0.0

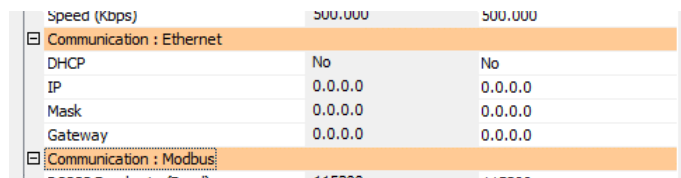
Enable DHCP:
 IF TRUE, enable DHCP function
 Change is taken after drive restart

IP Address:
 Configure the IP Address of the device.
 Format is coded like Following:
 192.168.1.1 => 0xC0 A8 01 01
 !! Specific value. If last Byte is 255 (0xFF) this is not 255 taken, but SMD nodeID (Set by DIPs)
 Change is taken after drive restart

SubNet Mask
 Configure the SubNet mask of the device.
 Format is coded like Following:
 255.255.255.0 => 0xFF FF FF 00
 Change is taken after drive restart

Gateway:
 Configure the Gateway of the device.
 Format is coded like Following:
 192.168.1.1 => 0xC0 A8 01 01
 Change is taken after drive restart

These parameters can be changed via DriveStudio and applied on SMD power On:



II.3 Modbus

II.3.1 Services

Below is listed all Modbus services. In grey are the not supported services.

				Function Codes		
				Code (Dec)	Sub code	Code (Hex)
Data Access	Bit access	Physical Discrete Inputs	Read discrete Inputs	2		02
		Internal Bits Or Physical coils	Read Coils	1		01
			Write Single Coil	5		05
			Write Multiple Coils	15		0F
	16 bits access	Physical Input Registers	Read Input Register	4		04
			Read Holding Registers	3		03
		Internal Registers Or Physical Output Registers	Write Single Register	6		06
			Write Multiple Registers	16		10
			Read/Write Multiple Registers	23		17
			Mask Write Register	22		16
			Read FIFO Queue	24		18
	File record access	Read File record		20	6	14
		Write File record		21	6	15
	Diagnostics			Read Exception status	7	
Diagnostic				8	0, 1, 2, 4, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20	08
Get Com event counter				11		0B
Get Com Event Log				12		0C
Report Slave ID				17		11
Read device identification				43	14	2B
Other				Encapsulated interface Transport	43	

II.3.2 RTU (Serial / USB)

Some dictionary objects are also accessible via the serial port or USB link (Serial emulation).

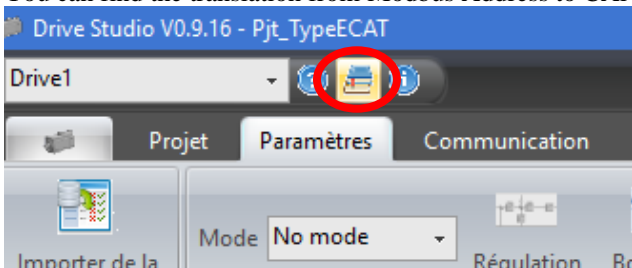
The used protocol is the Modbus RTU. The access via USB or Serial port are strictly identical. The USB is seen by computer as an emulated serial port. The only difference is the SlaveID field. USB is always 0x01. Serial is the node ID selected by the dips switch.

With this protocol, all communications on Serial/USB are initiated by the Master (Computer). Then the drive response can be positive or negative.

	Slave ID	ServiceID	StartAddr		NB Words		NB Bytes	Word(n)		CRC (2 Bytes)
SingleWriteRequest	0x01	0x06	MSB	LSB				MSB	LSB	CRC
SingleWriteResponse	0x01	0x06	MSB	LSB				MSB	LSB	CRC
SingleWriteNegResponse	0x01	0x86	Error code (1byte)							CRC
WriteRequest	0x01	0x10	MSB	LSB	MSB	LSB	LSB	MSB	LSB	CRC
WriteResponse	0x01	0x10	MSB	LSB	MSB	LSB				CRC
WriteNegResponse	0x01	0x90	Error code (1byte)							CRC
ReadRequest	0x01	0x03	MSB	LSB	MSB	LSB				CRC
ReadResponse	0x01	0x03					LSB	MSB	LSB	CRC
ReadNegResponse	0x01	0x83	Error code (1byte)							CRC
Other Neg Response	Req	Req 0x80	Error code (1byte)							CRC

If 32 bits data are read, by default the **little endian** is configured (16bits LSB first). This can be changed via “Gateway COM parameters 0x2200 object”

You can find the translation from Modbus Address to CANOpen object with DriveStudio:



Then you can have the direct correspondence between the Modbus Address and the CANOpen object:

- Ecriture de la valeur du modulo sur l'axe (PARAM POSITION MODULO VALUE)
On souhaite passer ce modulo à 360 degrés
`WRITEPARAM(2700h, 05h)=36000`
*Le modulo est maintenant de 360 degrés

Address	Modbus Address	Name	Description	Size	Type	Unit / Value	Access	Read Index	Read Sub Index	Write Index	Write Sub Index
		_FIRMWARE_ACTUAL_VERSION_STRING	Actual Version String	2	String		_WRITE_DENIED	1007h	00h		
10	400011	_FIRMWARE_VERSION_STRING	Version String	2	String		_WRITE_FACTORY	2203h	01h	2203h	01h
20	400021	_FIRMWARE_DATA_LENGTH	Data Length	2	Uint32		_WRITE_FACTORY	2203h	02h	2203h	02h
22	400023	_FIRMWARE_CRC	CRC	2	Uint32		_WRITE_FACTORY	2203h	03h	2203h	03h
24	400025	_FIRMWARE_COMMAND	Command	1	Uint16		_WRITE_FACTORY			2203h	04h
25	400026	FIRMWARE RESET VECTOR	Reset Vector	2	Uint32		_WRITE_FACTORY	2203h	05h	2203h	05h

The error code on Modbus RTU level could be following:

0x01	Service not supported	The filed "Service ID" not correspond to a supported service by the drive.
0x02	Unknown Address	The StartAddr + NbWord overflow the maximal supported address
0x03	Incorrect data	The frame is not correct (Length consistency...)
0x04	Drive not ready	In case of specific command (OS / PGM update) the drive is not in a good state
0xF7	Write default	During programming OS/Drive Basic if write fail.
0xF8	Buffer too small	Modbus request need larger buffer response. Try with smaller request.
0xF9	Memory Allocation	Internal system memory allocation fails. Please contact manufacturer

The error code on Object dictionary level could be following:

Code	Correspondence with CANOpen Abort code	Detail
0x05	0x6010001	Unsupported Access
0x06	0x6010001	Write Only entry: Try to read an object with Write Only attribute
0x07	0x6010002	Read Only entry: Try to write an object with Read Only attribute
0x08	0x6010003	Entry cannot be written because Subindex0 is not 0
0x09	0x6010004	The object cannot be accessed via complete access
0x0A	0x6020000	Object not existing
0x0B	0x6040041	Object cannot be mapped to PDO
0x0C	0x6040042	Mapped Object exceeds PDO
0x0D	0x6040043	Parameter is incompatible
0x0E	0x6040047	Device incompatibility
0x0F	0x6060000	Hardware error
0x10	0x6070010	Parameter length error
0x11	0x6070012	Parameter is too long
0x12	0x6070013	Parameter is too short
0x13	0x6090011	SubIndex (Entry) not exists
0x14	0x6090030	Value exceeds
0x15	0x6090031	Value is too great
0x16	0x6090032	Value is too small
0x17	0x6060033	Unequal Module Id list
0x18	0x6090036	Value is less than minimum value
0x19	0x8000000	General error
0x1A	0x8000020	Data cannot be read or written
0x1B	0x8000021	Data cannot be accessed because of local control
0x1C	0x8000022	Data cannot be read or written in the current state
0x1D	0x8000023	Object is not in the object dictionary
0x1E	0x8000024	No data available



The error code 0x6010002 (Read Only entry) id generated only when try to write ONE object. If the read only object is acceded in writing when Modbus frame access to many objects, all other object will be written, excepted the Read Only object, without return the error code.

II.3.3 Modbus TCP

The object access (mapping) is exactly the same than Modbus RTU.

	Transaction identifier		Protocol identifier		Length		Unit Identifier	ServiceID	StartAddr		NB Words		NB Bytes	Word(n)	
	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x10	MSB	LSB	MSB	LSB	LSB	MSB	LSB
WriteRequest	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x10	MSB	LSB	MSB	LSB	LSB	MSB	LSB
WriteResponse	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x10	MSB	LSB	MSB	LSB			
WriteNegResponse	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x90	Error code (1byte)						
ReadRequest	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x03	MSB	LSB	MSB	LSB			
ReadResponse	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x03					LSB	MSB	LSB
ReadNegResponse	MSB	LSB	0x00	0x00	MSB	LSB	0xFF	0x83	Error code (1byte)						
Other Response	Neg Req	Req	Req	Req	Req	Req	Req	Req 0x80	Error code (1byte)						

Fields	Length	Description -	Client	Server
Transaction Identifier	2 Bytes	Identification of a MODBUS Request / Response transaction.	Initialized by the client	Recopied by the server from the received request
Protocol Identifier	2 Bytes	0 = MODBUS protocol	Initialized by the client	Recopied by the server from the received request
Length	2 Bytes	Number of following bytes	Initialized by the client (request)	Initialized by the server (Response)
Unit Identifier	1 Byte	Identification of a remote slave connected on a serial line or on other buses.	Initialized by the client	Recopied by the server from the received request

The header is 7 bytes long:

- **Transaction Identifier:** It is used for transaction pairing; the MODBUS server copies in the response the transaction identifier of the request.
- **Protocol Identifier:** It is used for intra-system multiplexing. The MODBUS protocol is identified by the value 0.
- **Length:** The length field is a byte count of the following fields, including the Unit Identifier and data fields.
- **Unit Identifier:** This field is used for intra-system routing purpose. It is typically used to communicate to a MODBUS or a MODBUS+ serial line slave through a gateway between an Ethernet TCP-IP network and a MODBUS serial line. This field is set by the MODBUS Client in the request and must be returned with the same value in the response by the server. The SMD has not a gateway;
 - 0x00 => Broadcast: all slave receives the request. No response is done
 - 0xFF => Server is addressed
 - Other => To the gateway (not used)

All MODBUS/TCP ADU are sent via TCP on registered port 502. With this port, the Endianness for 32 bits value is configurable (Refer to RS232 port Endianness which is the same parameter) If port 10502 is used, Little Endian is always applied.

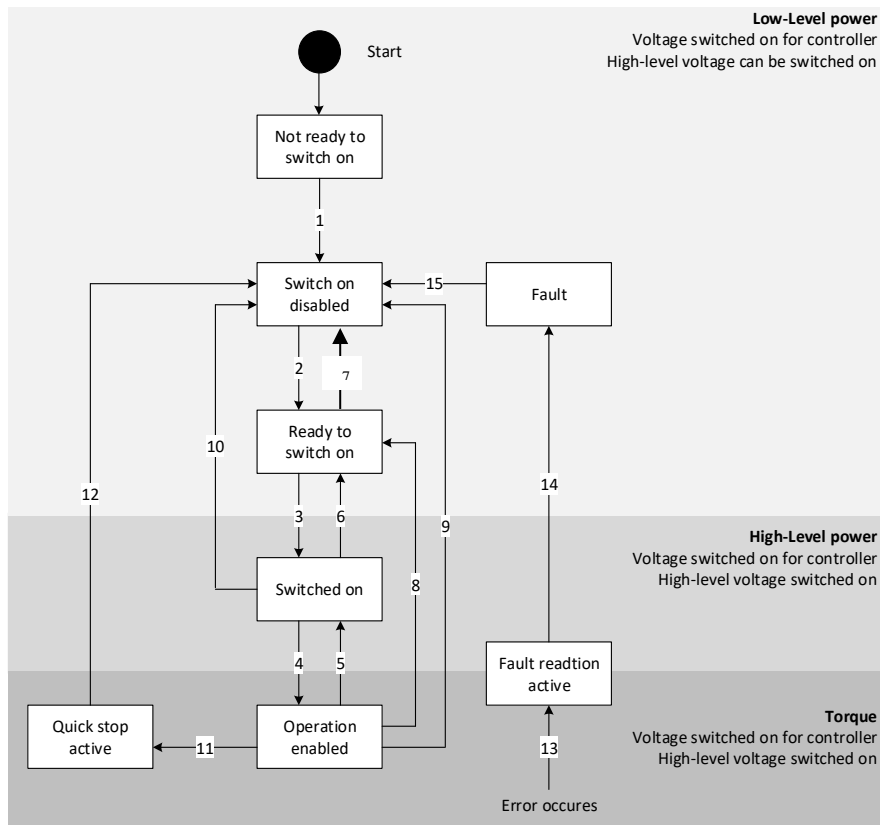
Remark: the different fields are encoded in Big-endian.

III. Drive profile application

III.1 General concepts

III.1.1 DS402 Power State Machine

To switch the motor controller to an operational state, a state machine must be run through. This is defined in CANopen standard DS402. State changes are requested in object 0x6040 (control word). The actual state of the state machine can be read out from object 0x6041 (status word).



The following table lists the bit combinations for the control word that lead to the corresponding state transitions. An X corresponds to a bit state that is no longer to be considered. The single exception is the fault reset: The transition is only requested by the rising edge of the bit.

Command	Bits of the <i>controlword</i>					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
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 (NOTE)
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset		X	X	X	X	15

NOTE Automatic transition to Enable operation state after executing SWITCHED ON state functionality.

The following table lists the bit masks that describe the state of the motor controller:

Status word	PDS FSA state
xxxx xxxx x0xx 0000 _b	Not ready to switch on
xxxx xxxx x1xx 0000 _b	Switch on disabled
xxxx xxxx x01x 0001 _b	Ready to switch on
xxxx xxxx x01x 0011 _b	Switched on
xxxx xxxx x01x 0111 _b	Operation enabled
xxxx xxxx x00x 0111 _b	Quick stop active
xxxx xxxx x0xx 1111 _b	Fault reaction active
xxxx xxxx x0xx 1000 _b	Fault

III.1.2 Modes of operation

The drive behaviour depends on the activated mode of operation. The drive implements several modes of operation but it is not possible to operate the modes in parallel, the user is able to activate the required function by selecting a mode of operation.

The control device writes to the *modes of operation* object (0x6060) in order to select the operation mode. The drive device provides the *modes of operation display* object (0x6061) to indicate the actual activated operation mode. Controlword, Statusword, and set-points are used mode-specific. This implies the responsibility of the control device to avoid inconsistencies and erroneous behaviour.

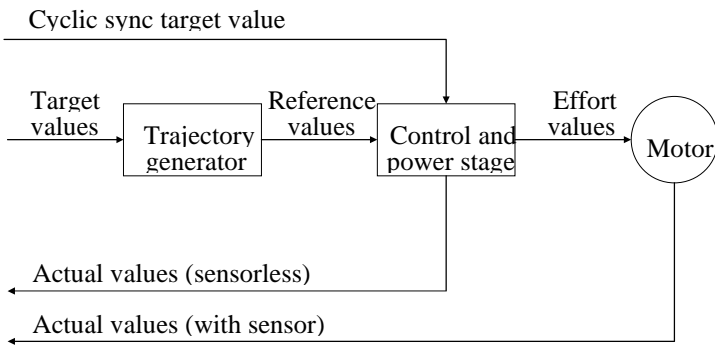
The following modes of operation are available:

- Profile position mode (ppm)
- Homing mode (hm)
- Interpolated position mode (ipm)
- Profile velocity mode (pvm)
- Torque profile mode (ptm)
- Cyclic sync position mode (csp)
- Cyclic sync velocity mode (csv)
- Cyclic sync torque mode (cst)
- Auto-Tuning mode (atm)*
- GearBox mode (gbm)*
- Homing master mode (hmm)*

With the exception of the 'Homing mode', the listed modes of operation deal with set-points.

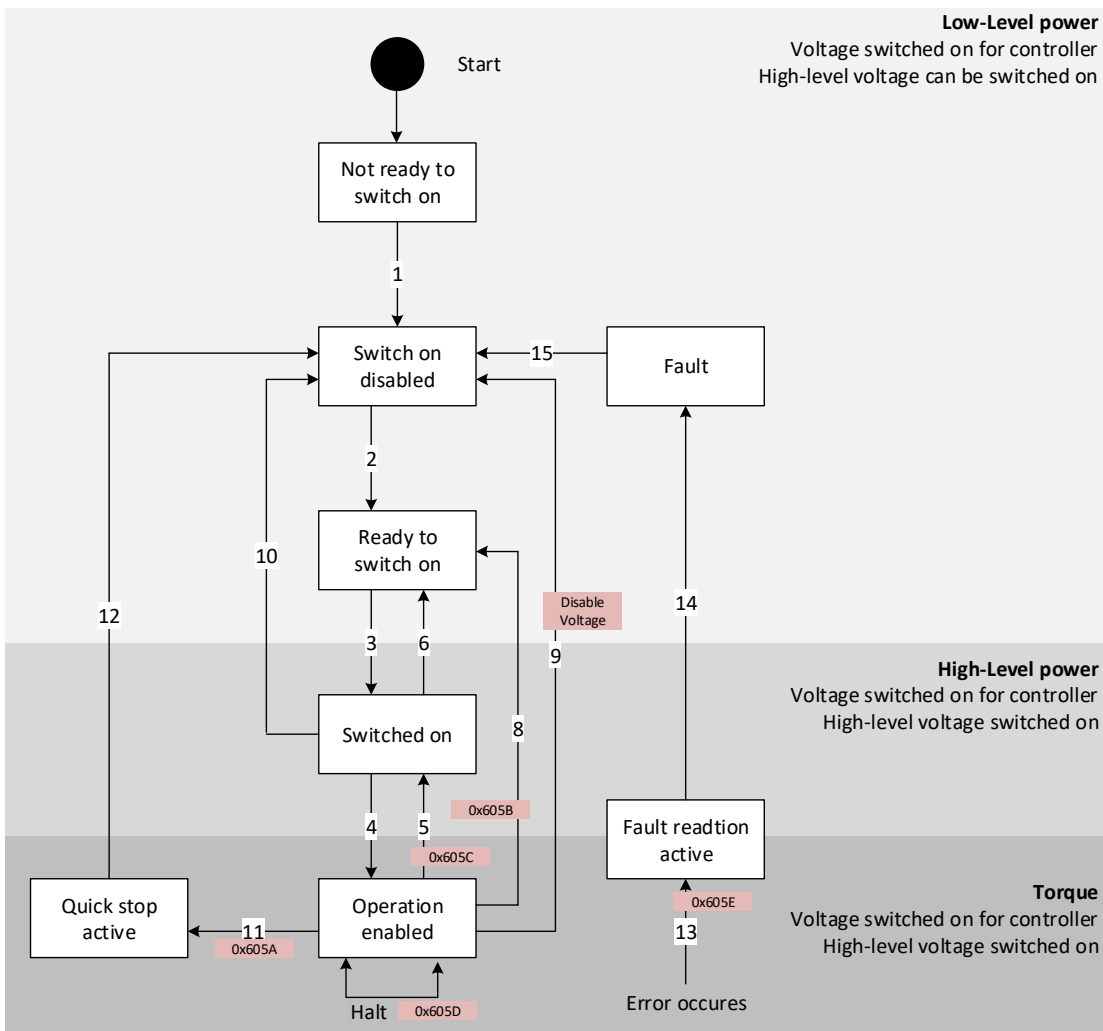
*Manufacturer specific mode

Figure below shows the general relations between target, reference, effort, and actual values:



III.1.3 Brake reaction

Different brake reactions can be set according source of the event.



III.1.3.1 Quick stop active

Transition to the “Quick stop active” state and the Halt command. In this case, the action configured in object 0x605A is performed:

Value	Definition
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 current limit and transit into Switch On Disabled
+4	Slow down on 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 current limit and stay in Quick Stop Active
+8	Slow down on voltage limit and stay in Quick Stop Active

III.1.3.2 Shutdown

Transition to the “Ready to switch on” state. In this case, the action configured in object 0x605B is performed:

Value	Definition
0	Disable drive function (switch-off the drive power stage)
+1	Slow down with slow down ramp; disable of the drive function

III.1.3.3 Disable operation

Transition to the “Switched on” state. In this case, the action configured in object 0x605C is performed:

Value	Definition
0	Disable drive function (switch-off the drive power stage)
+1	Slow down with slow down ramp; disable of the drive function

III.1.3.4 *Halt operation*

This bit of the control word is available in the following mode:

- Profile Position
- Profile Velocity
- Profile Torque
- Homing
- Interpolated position
- Auto-Tuning

In this case, the action configured in object 0x605D is performed:

Value	Definition
+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 stay in Operation Enabled

III.1.3.5 *Fault reaction operation*

If an error occurs, the action configured in object 0x605E is performed:

Value	Definition
0	Disable drive function, motor is free to 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

III.1.4 Safety

The drive has two STO inputs.

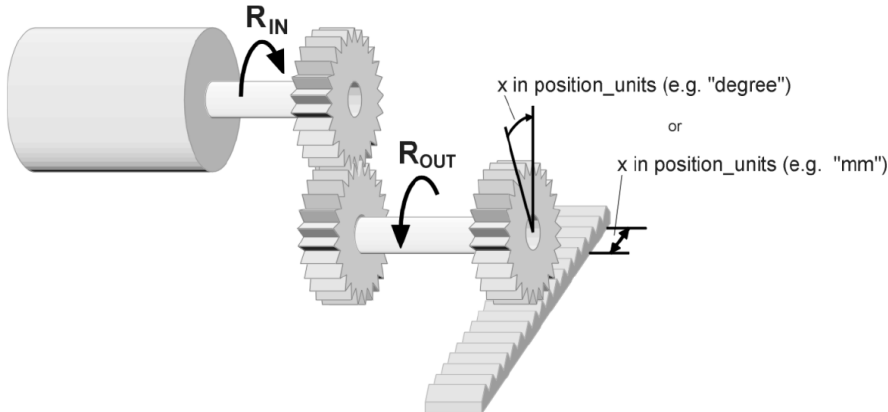
- A fault on one of the STO inputs, internally generates a Warning (A04, A05). The action on this Warning is not a "Fault Signal", but a "Disable voltage" » (see III.1.1 DS402 Power State Machine : Transition 7, 9, 10, 12). Indeed, due to hardware, a STO detection switch off the motor control which is equivalent to a Disable voltage. We cannot apply a deceleration ramp.
If the user wishes to decelerate (mechanical safety) and then a Disable Voltage (electrical safety) it must be managed on the master side: Make a Halt or QuickStop command and then a Disable Voltage command (Manage by quick stop config)
- The STO error disappears automatically when the fault disappears. (No more display A04, A05), but is still present in the fault history.
- To Switch On again, you need a rising edge of ENABLE (Shutdown request and then Operation Enable request, or rising edge on ENABLE input, or Drive Basic instruction « Axis On »)

Command Mode	Type of ENABLE input	Action to do
DriveStudio	None	Following a STO, the user must press OFF, then ON when the STO are OK to enable again.
	Authorization	Following a STO, the user must press OFF, then ON when the STO are OK to enable again provided the ENABLE input is enabled.
	Validation	No more control via DriveStudio. The ENABLE input must have a rising edge when the STO are OK to enable again.
COM (CAN,...)	None	Following a STO, the ControlWord has to go to 0x06 (Shutdown) then 0x07 (OperationEnable) when the STO are OK to enable again.
	Authorization	Following a STO, the ControlWord has to go to 0x06 (Shutdown) then 0x07 (OperationEnable) when the STO are OK to enable again provided the ENABLE input is enabled.
	Validation	The ControlWord has to go to 0x06 (Shutdown) as well as the ENABLE input to 0. A rising edge on the ENABLE input or an Operation Enable request (ControlWord = 0x07, 0x0F) with STO OK allows you to enable again.
DriveBasic	None	Following a STO, the user must call the instruction "Axis On", when the STO are OK to enable again.
	Authorization	Following a STO, the user must call the instruction "Axis On", when the STO are OK to enable again provided the ENABLE input is enabled.
	Validation	No more control via Axis On / Off instruction. The ENABLE input must have a rising edge with the STO Ok to enable again.

III.1.5 User defined unit

The Drives controller supports the possibility to set “User-defined” unit. By this way, the corresponding parameters can be set and read directly in the wanted user unit (mm, degree, lap etc...)

To configure it, we define the notion of the “Factor group”



III.1.5.1 Position User defined (P.u.d)

Gear ratio

The object 0x6091 define the gear ratio. This object shall indicate the configured number of motor shaft revolutions (R_{in}) and the number of driving shaft revolution (R_{out})

Feed constant

The object 0x6092 define the feed constant. This object shall indicate the configured feed constant; this is the measurement distance per one revolution of the output shaft of the gearbox.

Example

- System has a gear box ration of 1/10 ($R_{out} = 1$ revolution per 10 revolutions of the motor)
- System has a feed constant of 10mm per revolution (10mm done when output shaft of the gearbox makes one revolution)
- User want indicate the distance in μm (If want a target position of 1mm, user send the '1000' to the target position)

To obtain this, the user shall:

- Configure the Gear Ratio with {1, 10}
- Configure the Feed constant with {10000, 1} (10mm = 10000 μm)

III.1.5.2 Velocity User defined (V.u.d)

The user can define a different scale from the P.u.d.

To do this, the object 0x6096 define the velocity factor.

Example

On the P.u.d example (1 P.u.d. = 1 μm)

- If user want define the velocity in $\mu\text{m/s}$, the Velocity factor should be configured to {1, 1}
- If user want define the velocity in mm/s, the Velocity factor should be configured to {1000, 1}
- If user want define the velocity in m/min, the Velocity factor should be configured to {1000000, 60} => (μm -> m: x1000000, s-> min: x60)

III.1.5.3 Acceleration User defined (A.u.d.)

The user can define a different scale from the P.u.d.

To do this, the object 0x6097 define the acceleration factor.

III.1.5.4 Jerk User defined (J.u.d.)

The user can define a different scale from the P.u.d.

To do this, the object 0x60A2 define the jerk factor.

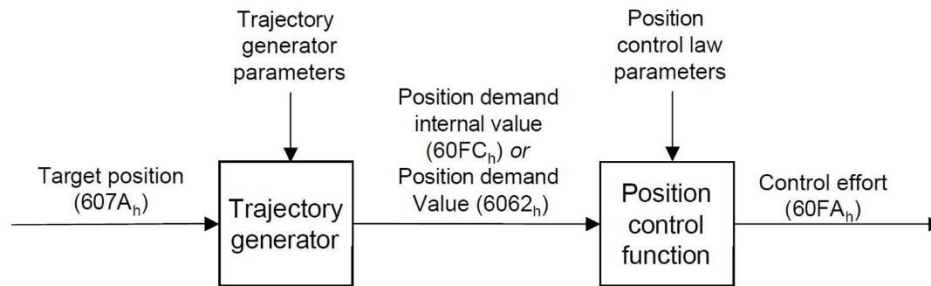
III.2 Mode of operation

III.2.1 Profile position (pp mode)

III.2.1.1 General information

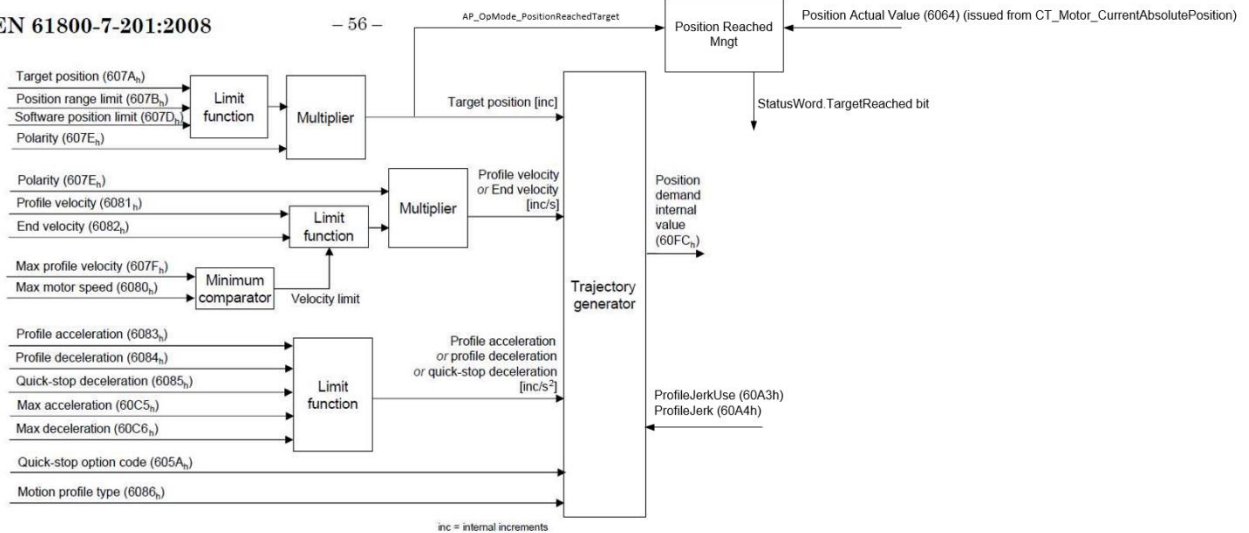
The Profile Position Mode is used to move to the target position (relative or absolute) with a defined trajectory (speed, acceleration, deceleration and jerk).

The overall structure for this mode is shown below. A target position is applied to the trajectory generator. It is generating a position demand value for the position control loop.



At the input to the trajectory generator, parameters may have optional limits applied before being normalized to internal units. The simplest form of a trajectory generator is just to pass through a target position and to transform it to a position demand internal value with internal units (increments) only.

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III.2.1.2 Functional description

Control Word

15	11	10	9	8	7	6	5	4	3	0
(see 0x6040 description)	Infinite Move	Change on setpoint	Halt	(see 0x6040 description)	abs/rel	Change set immediately	New setpoint	(see 0x6040 description)		
MSB		LSB								

The following bits in object 0x6040 (control word) have a special function:

- Bit 4 starts a new set-point order. This is carried out on a rising edge of this bit.
- Bit 5: If this bit is set to "1", the Set-point order is triggered immediately on bit 4 rising. If it is set to "0", the Set-point order just being carried out is completed and only then is the next Set-point order started.
- Bit 6: If "0", the target position 0x607A is absolute. If "1", the target position is relative to the actual position. The reference position is depending on the Bits 0 and 1 of the object 0x60F2.
- Bit 8 (Halt): At the transition from "0" to "1" the motor decelerates and will come to a halt. The deceleration is depending on the settings in the "Halt Option Code" in object 0x605D.
- Bit 9: If this bit is set, the speed is not changed until the first target position is changed. This means that braking is not performed before the first destination is reached as the motor should not stop at this position.
- Bit 10: Manufacturer specific: If this bit is set, indicate the move is infinite. End Velocity and Target position in not usable. This bit is only taken for immediately set (Bit 5 = 1). TO stop move, send a new set point or make a Halt request

Status Word

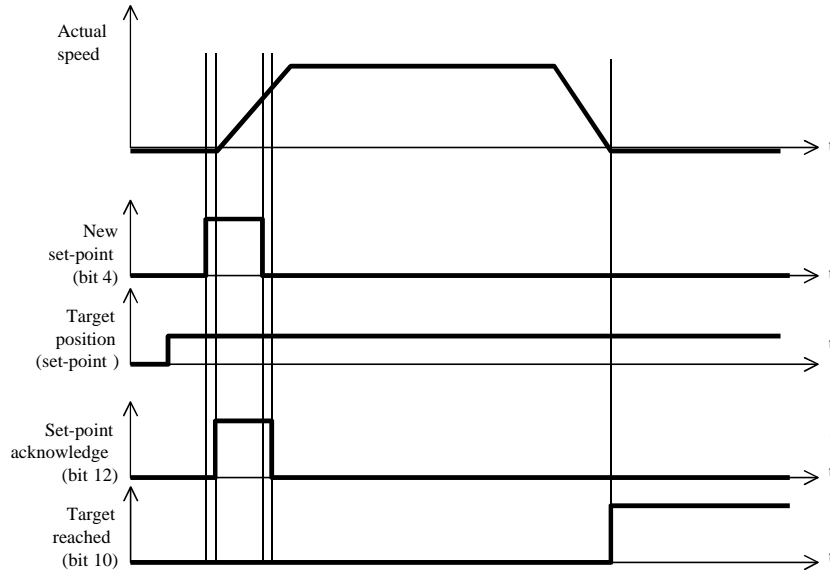
15	14	13	12	11	10	9	0
(see 0x6041 description)	Following error	Set-point acknowledge	(see 0x6041 description)	Target reached	(see 0x6041 description)		
MSB		LSB					

The following bits in object 0x6041 (status word) have a special function:

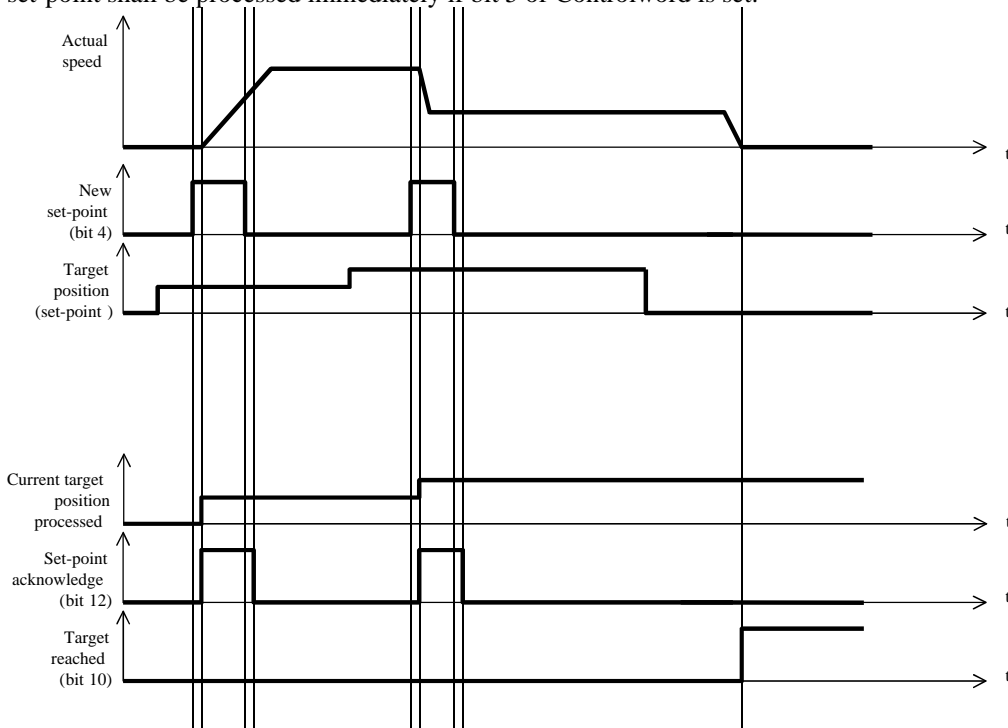
- Bit 10: Target reached: This bit is set to "1" when the last target was reached and the motor is idling for a specified time (0x6068) within a tolerance window 0x6067.
- Bit 12 (set-point acknowledge): This bit confirms the receipt of a new and valid target position. It is synchronously set and reset with the "New set-point" bit in the control word.
- Bit 13 (Following Error): This bit is set in closed loop mode if the following error is greater than the set limits is (0x6065 (Following Error Window) and 0x6066 (Following Error Time Out)).

General move command

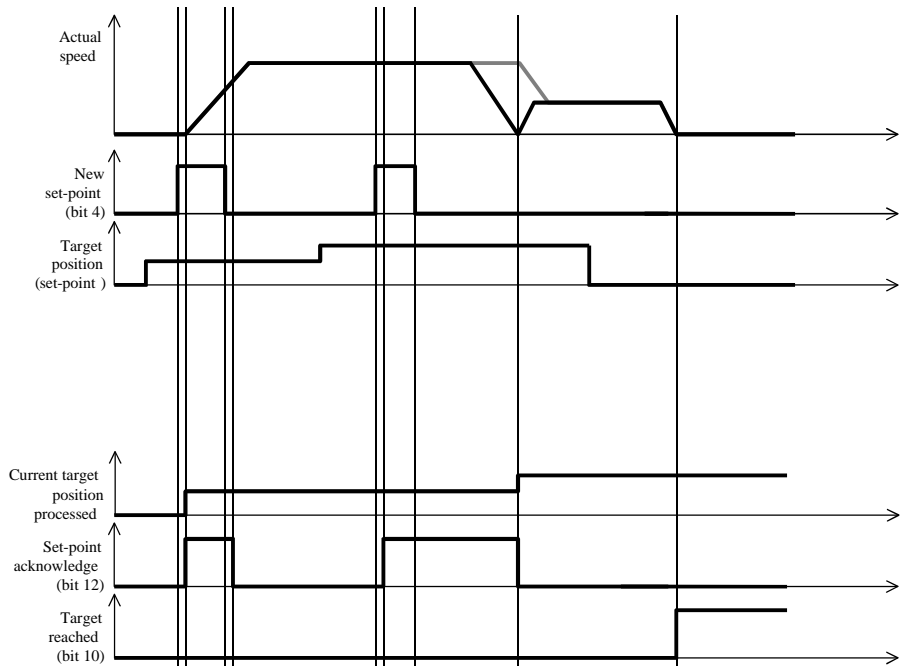
In object 0x607A (Target Position), the new target position is specified in Position User-Defined unit (P.u.d). Afterwards, the move command is triggered when bit 4 is set in object 0x6040 (control word). If the target position is valid, the drive responds with bit 12 in object 0x6041 (status word) and begins the positioning run. As soon as the position is reached, bit 10 is set to "1" in the status word.



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 if bit 5 of Controlword is set:

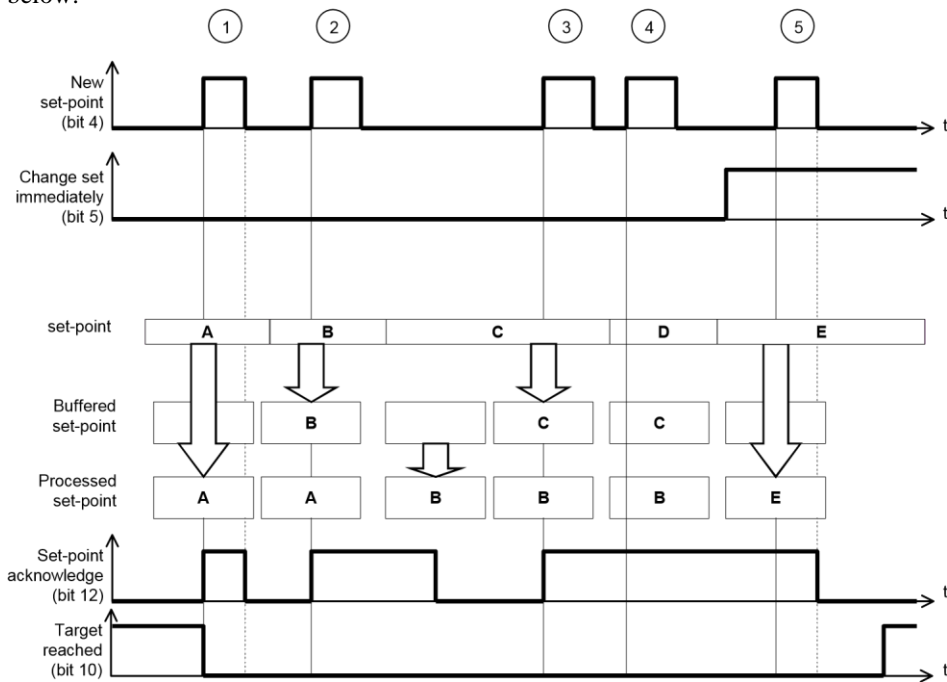


Or after the previous set-point was finished if bit 5 is cleared. The additional grey line segment in the graph 'actual speed' shows the actual speed if the change of set point bit (bit 9) is set to 1:



Set of set-points

The drive device supports set of set-points, maximum of 254 set-points is available. The set-points are handled as shown below:



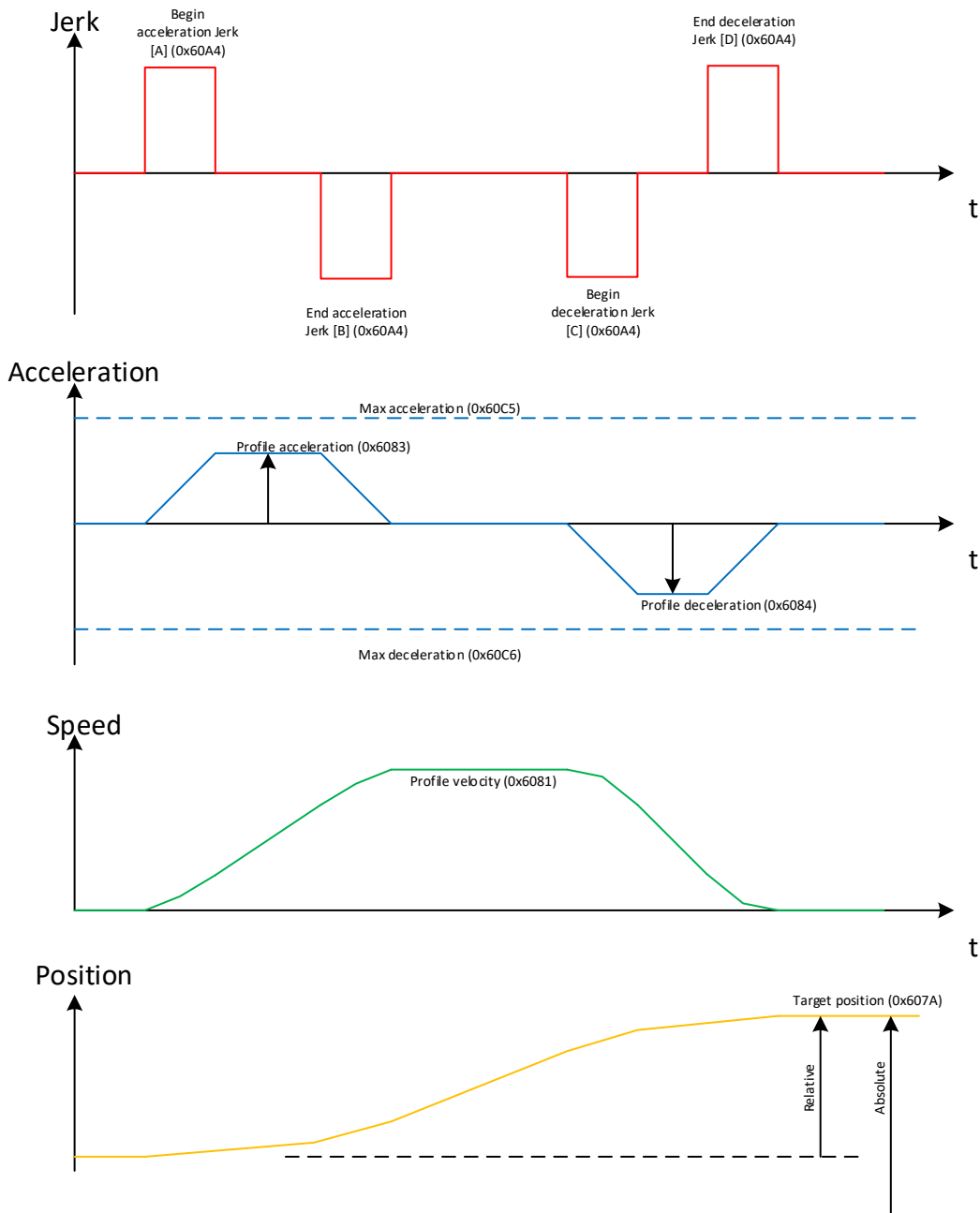
New set-points are buffered in the set-point list as long as free set-points are available in the drive device. If no set-point is in progress, the new set-point shall become active immediately (1). If a set-point is in progress, the new set-point shall be stored in the first set-point buffer that is free (2 + 3).

If all set-point buffers are busy (set-point acknowledge bit is 1), the reaction depends on the *change set immediately* bit. If the change set immediately bit is set to 1, the new set-point shall be processed immediately as single set-point. All previously loaded set-points shall be discarded (5).

The target reached bit shall remain 0 until all set-points are processed.

Parameters

The following diagram shows parameters used to establishing the profile.



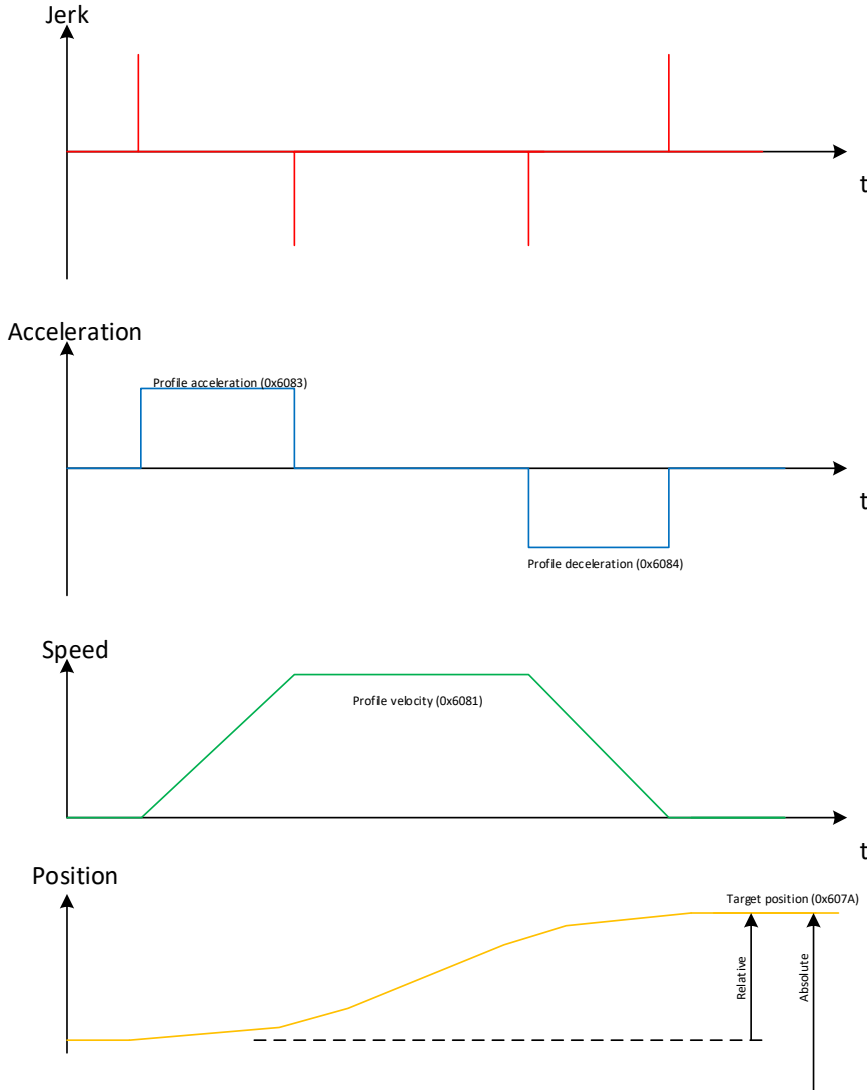
Motion Profile type

User can define a profile type (0x6086):

- Linear ramp (trapezoidal profile)
- Sin² ramp
- Jerk-free ramp
- Jerk-limited ramp (Not yet available)
- Jerk-limited ramp in rate

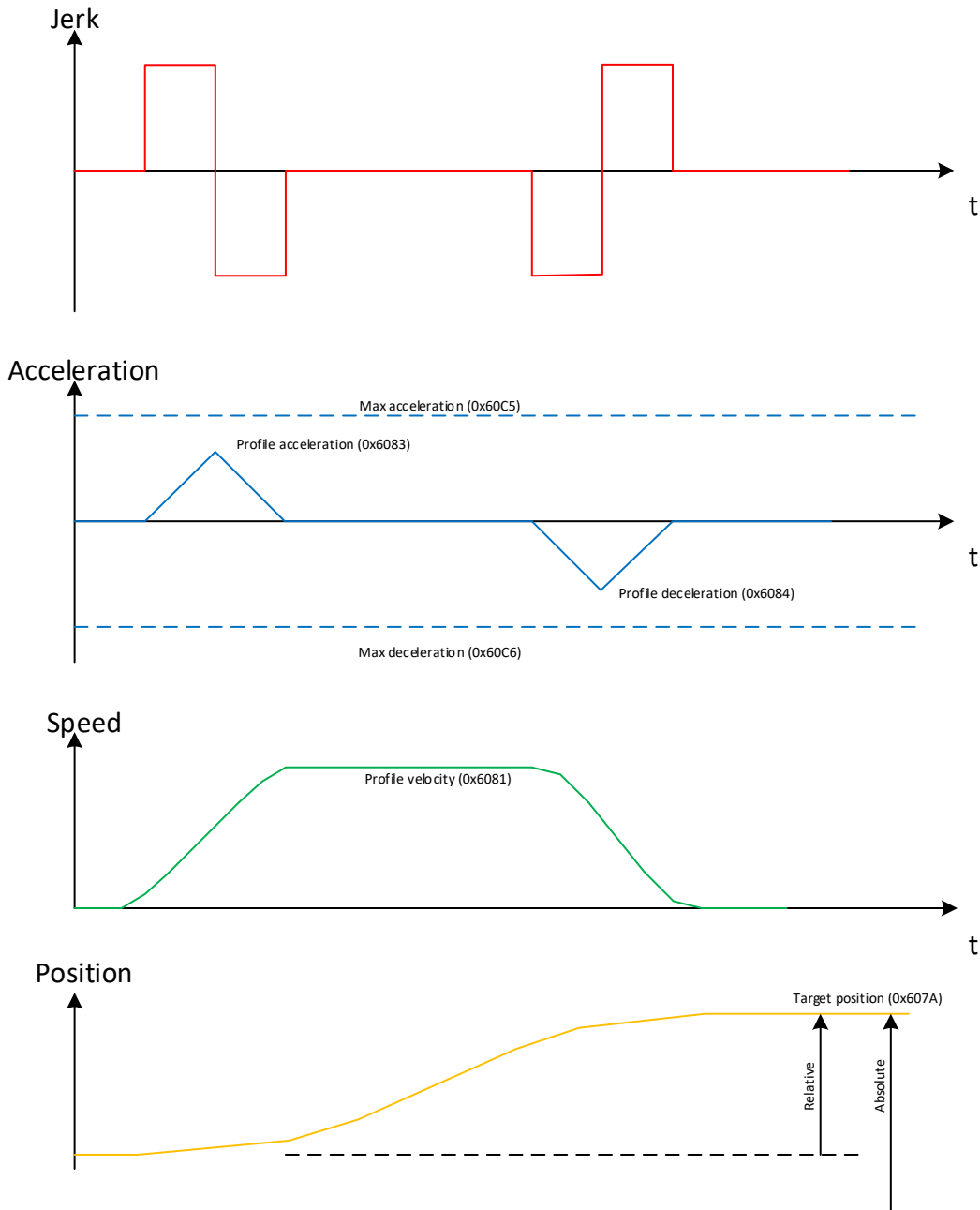
Linear ramp

In this mode, the Jerk is not used.



Jerk-Free ramp

In this mode, no jerk is used. The drive compute it automatically to have the smoother acceleration as possible:



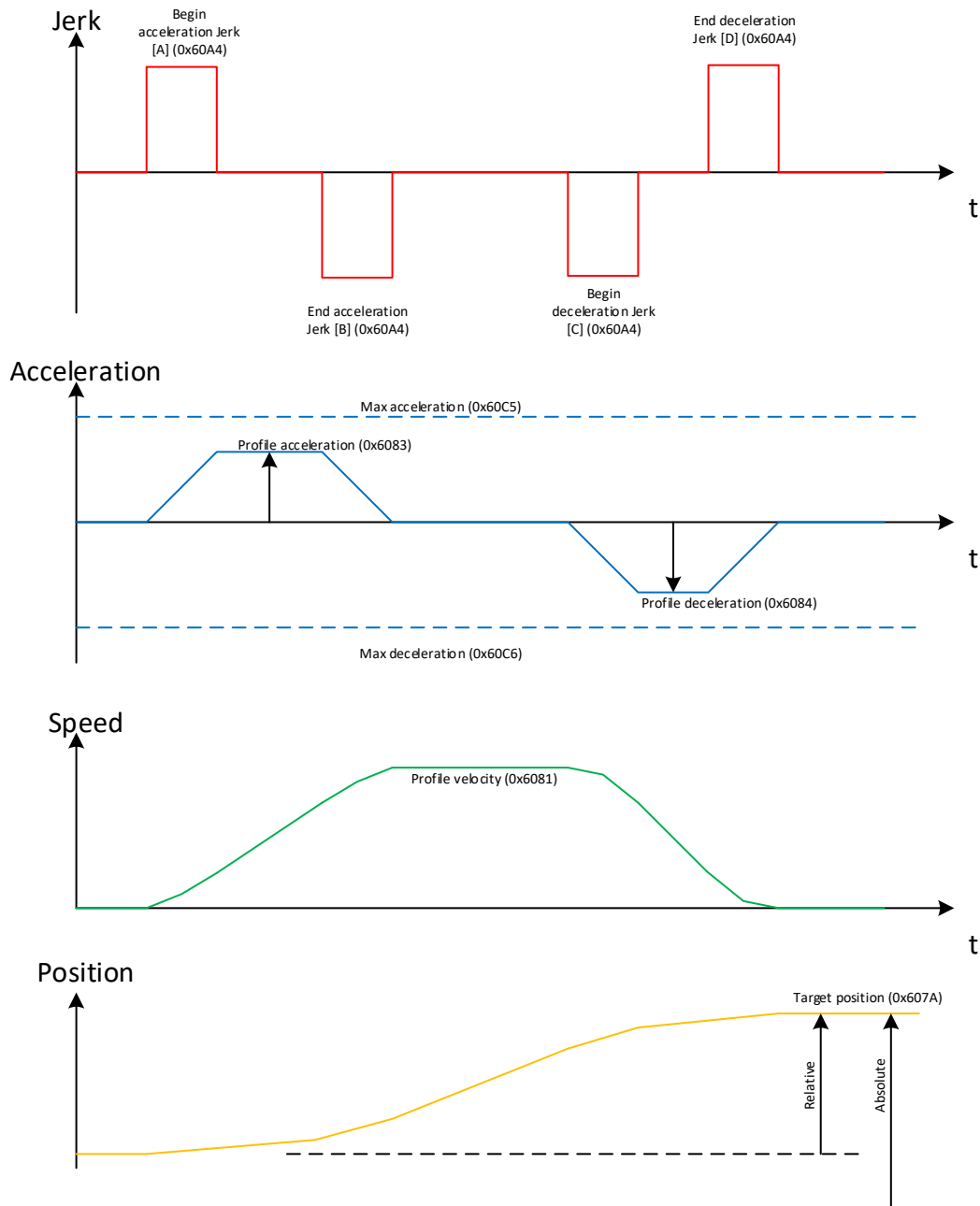
Jerk-Limited mode (Not Yet implemented)

In this mode, the user defines the wanted Jerk.

According the object 0x60A3 (Profile Jerk use), the acceleration Jerk can be different to Deceleration Jerk.

If Profile Jerk use (0x60A3) = 1, the Jerk in phase [A] [B] [C] and [D] is defined with Jerk 0x60A4.1.

If Profile Jerk use (0x60A3) = 2, the Jerk in phase [A] [B] is defined with Jerk 0x60A4.1. The Jerk in phase [C] and [D] is defined with Jerk 0x60A4.2.



Jerk-Limited in rate mode

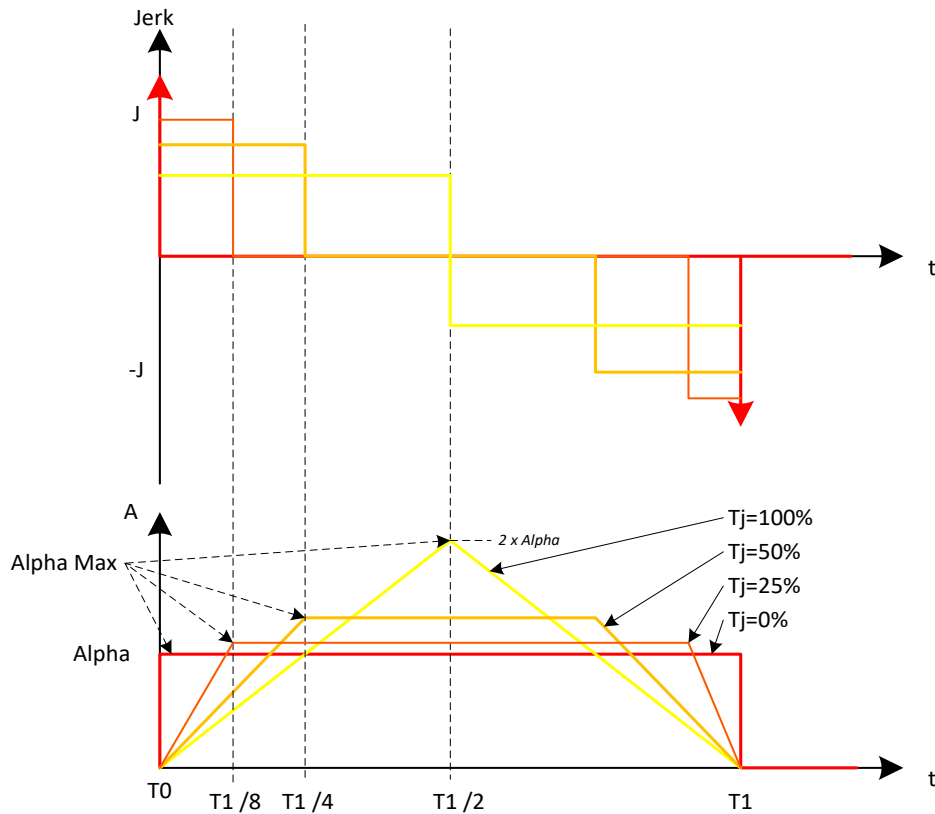
This mode is the same as Jerk-Limited mode. The only difference is the unit of the Jerk defined in object 0x60A4 is in percent (0...100).

0% mean no jerk (similar to Linear ramp)

100% is equivalent to Jerk-Free mode (Jerk increase and decrease without stabilized phase)

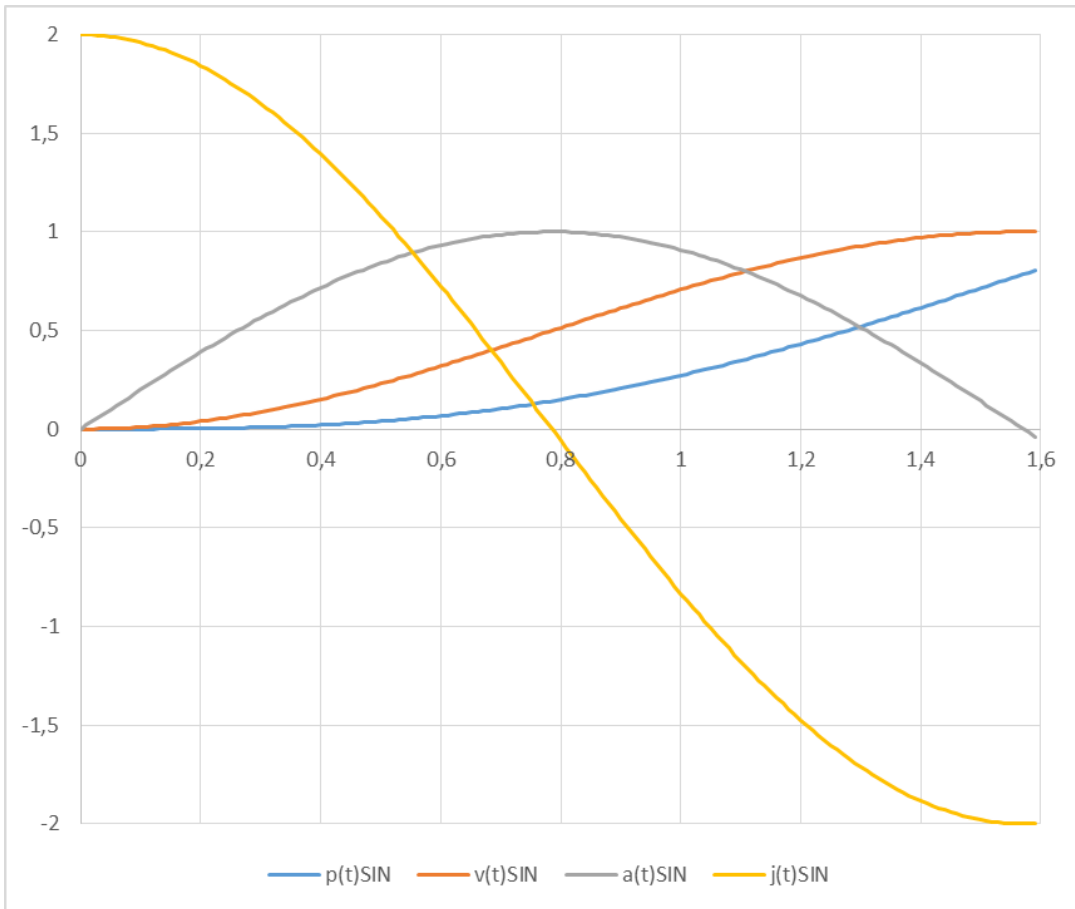
50% means:

- a positive Jerk during 25% of acceleration phase,
- A stabilized jerk during 50% of acceleration phase,
- A negative jerk during 25% of acceleration phase

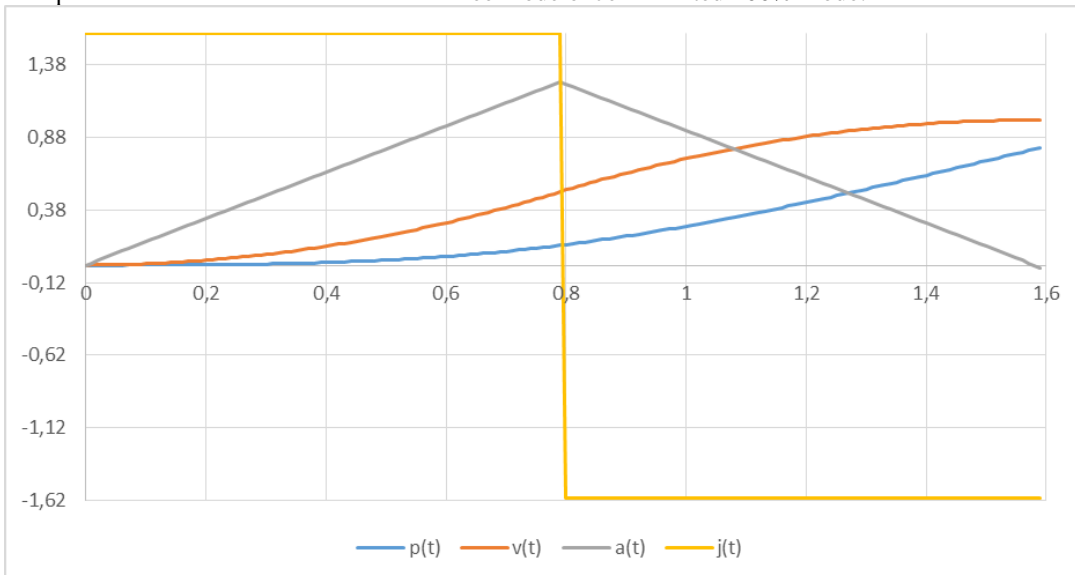


Sin² Ramp

In this phase, the acceleration follows a Sin² waveform:

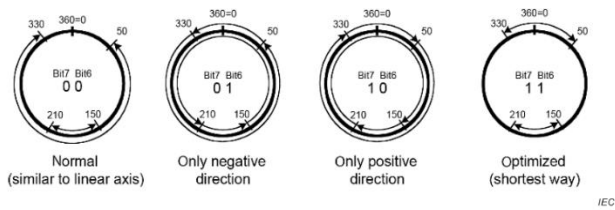


Compare to 'S' curve obtained with Jerk-Free mode or Jerk-limited 100% mode:



Positioning

Below is the different positioning mode (bit 6 and 7, object 0x60F2):



Be careful: using of “Modulo axis” (RangeLimit 0x607B) is only allowed on simple feedback. (QEP, resolver...). There is no sense to use this on multi turn feedback.

The object 0x607B Position range limit indicates the maximum and minimum position range limits. It limits the range of the input value. On reaching or exceeding these limits, the input value wraps automatically to the other end of range. The software position limit 0x607D shall be out of the range of the position range limits.

To disable the position range limits for any reason the min position range limit (607B:01) and max position range limit (607B:02) must be set to 0.

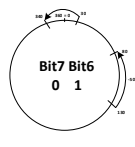
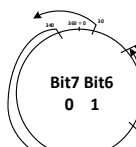
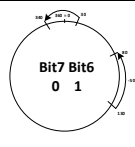
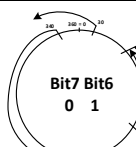
Normal mode

In this mode, we can move in multi-turn. (Example in a range = 0-360° -> 0x607B)

Target Position (0x607A)	Relative	Absolute	Absolute
0	Motor not move		Motor goes to position 0° in the negative sense.
50°	The motor move of 50° in positive sense.		The motor goes to 50°. (Without pass through 0°)
-50°	The motor move of 50° in negative sense.		-50° is equal to 360-50 = 310°. The motor goes to 310° by passing through 0°.
410° (1 turn + 50°)	The motor move of 1 lap + 50° in positive sense.		The motor goes to 50°. (By passing 1 time or n time through 0°)
-410° (1 tour + 50°)	The motor move of 1 lap + 50° in negative sense.		The motor goes to 310°. (By passing 2 times through 0°)

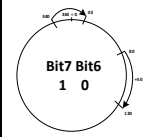
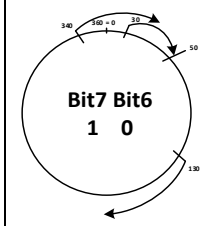
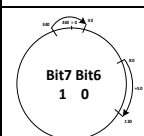
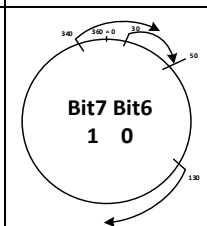
Negative mode

In this mode, we cannot do multi-turn.

Target Position (0x607A)	Relative		Absolute	
0	Motor not move		Motor goes to position 0° in the negative sense.	
50°	The motor move of 50° in negative sense.		The motor goes to 50° in negative sense.	
-50°	-50° = 310°. The motor move of 310° in negative sense.		-50° = 310°. The motor goes to 310° in negative sense.	
410° (1 tour + 50°)	410 = 50°. The motor move of 50° in negative sense.		410° = 50°. The motor goes to 50° in negative sense.	
-410° (1 tour + 50°)	-410° = 310°. The motor move of 310° in negative sense.		-410° = 310°. The motor goes to 310° in negative sense.	

Positive mode

In this mode, we cannot do multi-turn.

Target Position (0x607A)	Relative		Absolute	
0	Motor not move		Motor goes to position 0° in the negative sense.	
50°	The motor move of 50° in positive sense.		The motor goes to 50° in positive sense.	
-50°	-50° = 310°. The motor move of 310° in positive sense.		-50° = 310°. The motor goes to 310° in positive sense.	
410° (1 tour + 50°)	410 = 50°. The motor move of 50° in positive sense.		410° = 50°. The motor goes to 50° in positive sense.	
-410° (1 tour + 50°)	-410° = 310°. The motor move of 310° in positive sense.		-410° = 310°. The motor goes to 310° in positive sense.	

Optimized mode

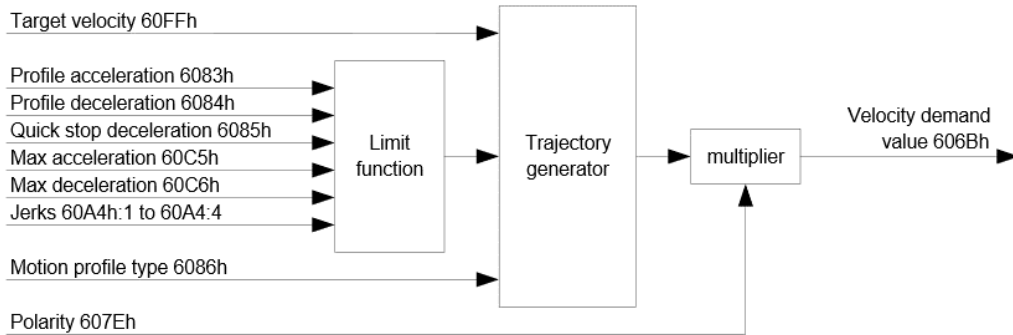
In this mode, we cannot do multi-turn.

Target Position (0x607A)	Relative	Absolute
0	Motor not move	Motor goes to position 0° in the sense: <ul style="list-style-type: none"> • Positive if current position $\geq 180^\circ$ • Else, negative.
50° (or n)	The motor move of 50° in positive sense. If $n \leq 180$: In the n sense. If $n > 180$: In the reverse n sense.	Motor goes to position 50°(n) in the sense: <ul style="list-style-type: none"> • Positive if current position $\geq 230^\circ (180^\circ + n)$ • Else, negative.
-50° (or n)	The motor move of 50° in negative sense. If $n \geq -180$: In the n sense. If $n < -180$: In the reverse n sense.	Motor goes to position 310°(360°-n) in the sense: <ul style="list-style-type: none"> • Negative if current position $\geq 130^\circ (180^\circ + n)$ • Else, positive.
410° (1 tour + 50°)	The motor move of 50° in positive sense.	Motor goes to position 50°(n) in the sense: <ul style="list-style-type: none"> • Positive if current position $\geq 230^\circ (180^\circ + n)$ • Else, negative. If $770^\circ = 410^\circ + 50^\circ$, the motor done 1 turn more
-410° (1 tour + 50°)	The motor move of 50° in negative sense.	Motor goes to position 310°(360-n) in the sense: <ul style="list-style-type: none"> • Negative if current position $\geq 130^\circ (180^\circ + n)$ • Else, positive. If $-770^\circ = -410^\circ - 50^\circ$, the motor done 1 turn more

III.2.2 Profile velocity (pv mode)

III.2.2.1 General information

The Profile Velocity Mode is used to control the speed of the axis with a defined profile (acceleration, deceleration, jerk...)



Each write to the Target Velocity object (0x60FF) will trig a new trajectory generation with configured parameters like:

- Acceleration / Deceleration
- Jerk

III.2.2.2 Functional description

Control Word

15	14	13	9	8	7	6	4	3	0
(see 0x6040 description)	Max Speed Error Ack	(see 0x6040 description)	Halt	(see 0x6040 description)	Reserved	(see 0x6040 description)			(see 0x6040 description)
MSB									LSB

The following bits in object 0x6040 (control word) have a special function:

- Bit 2 is used to trigger a quick stop. If it is set to "0", the motor carries out a quick stop with the ramp set in object 0x6085. Then the motor controller changes to the "Switch on disabled" state (0x6040).
- Bit 8 (Stop): On a transition of "0" to "1", the motor brakes and comes to a stop.

Status Word

15	14	13	12	11	10	9	0
(see 0x6040 description)	Max Speed Error	NA	Speed	(see 0x6040 description)	Target Reached	(see 0x6040 description)	

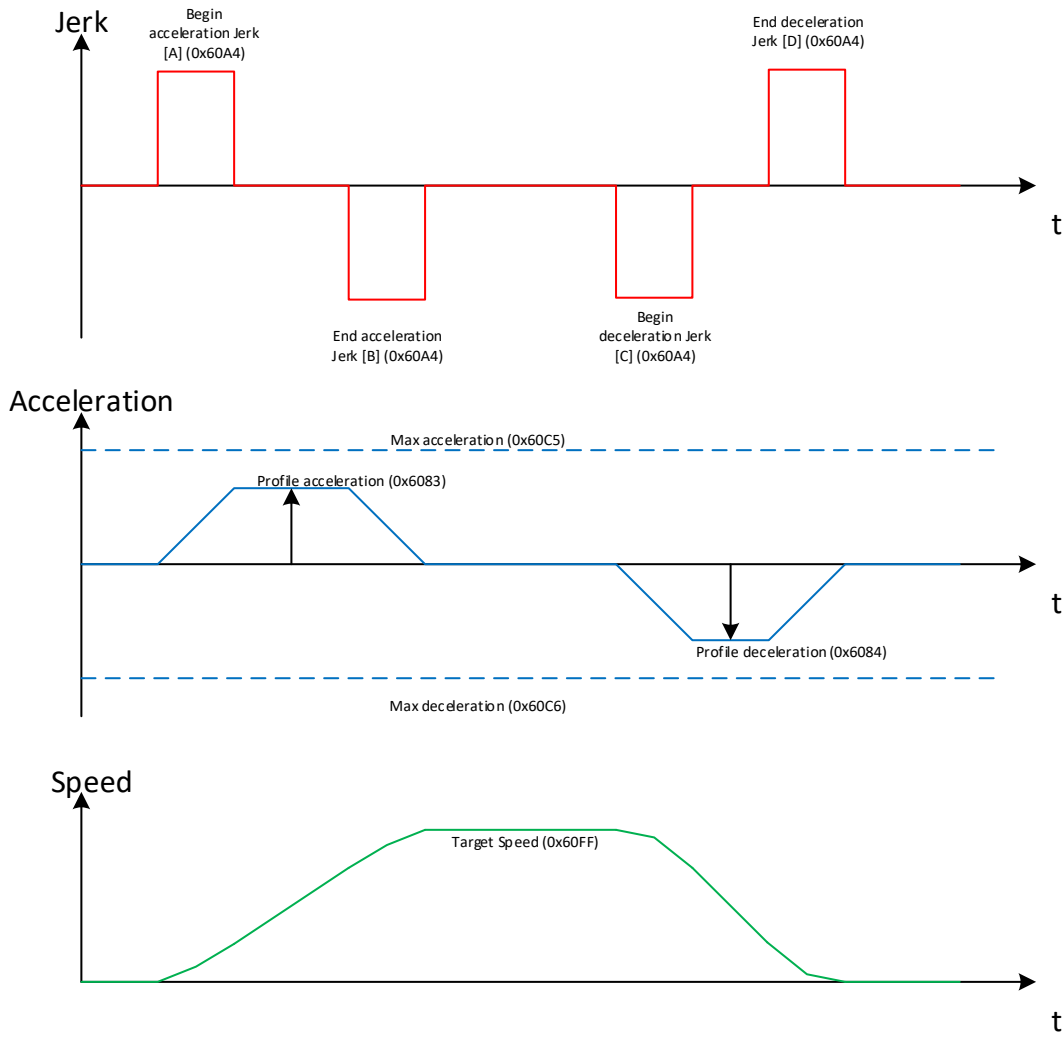
The following bits in object 0x6041 (status word) have a special function:

- Bit 10 (target speed reached); Target Reached: This bit in combination with bit 8 in the control word indicates whether or not the target speed has been reached, the motor is braking, or the motor is idling (see table).

0x6041 Bit 10	0x6040 Bit 8	Description
0	0	Target speed not attained
0	1	Axis is braking
1	0	The target speed within the target window (defined in 0x606D and 0x606E)
1	1	Speed of axis is 0

Parameters

The following diagram shows parameters used to establishing the profile.



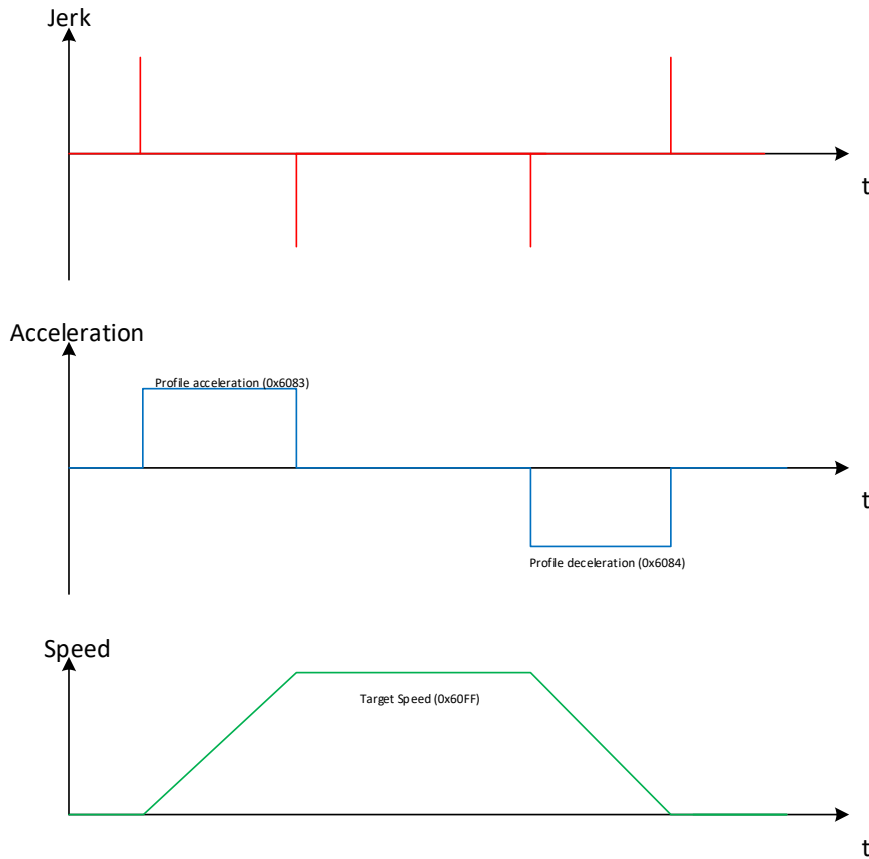
Motion Profile type

User can define a profile type (0x6086):

- Linear ramp (trapezoidal profile)
- Sin² ramp
- Jerk-free ramp
- Jerk-limited ramp
- Jerk-limited ramp in rate

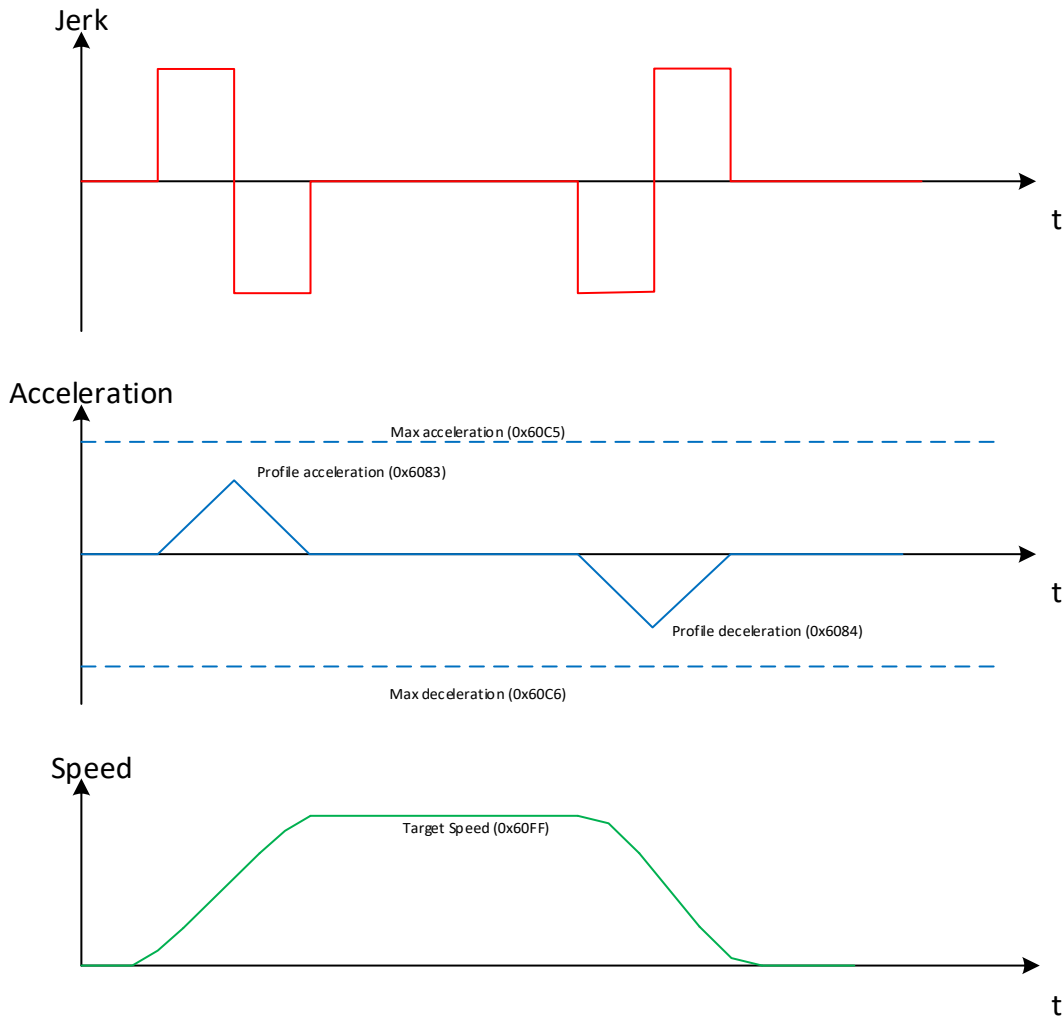
Linear ramp

In this mode, the Jerk is not used.



Jerk-Free ramp

In this mode, no jerk is used. The drive compute it automatically to have the smoother acceleration as possible:



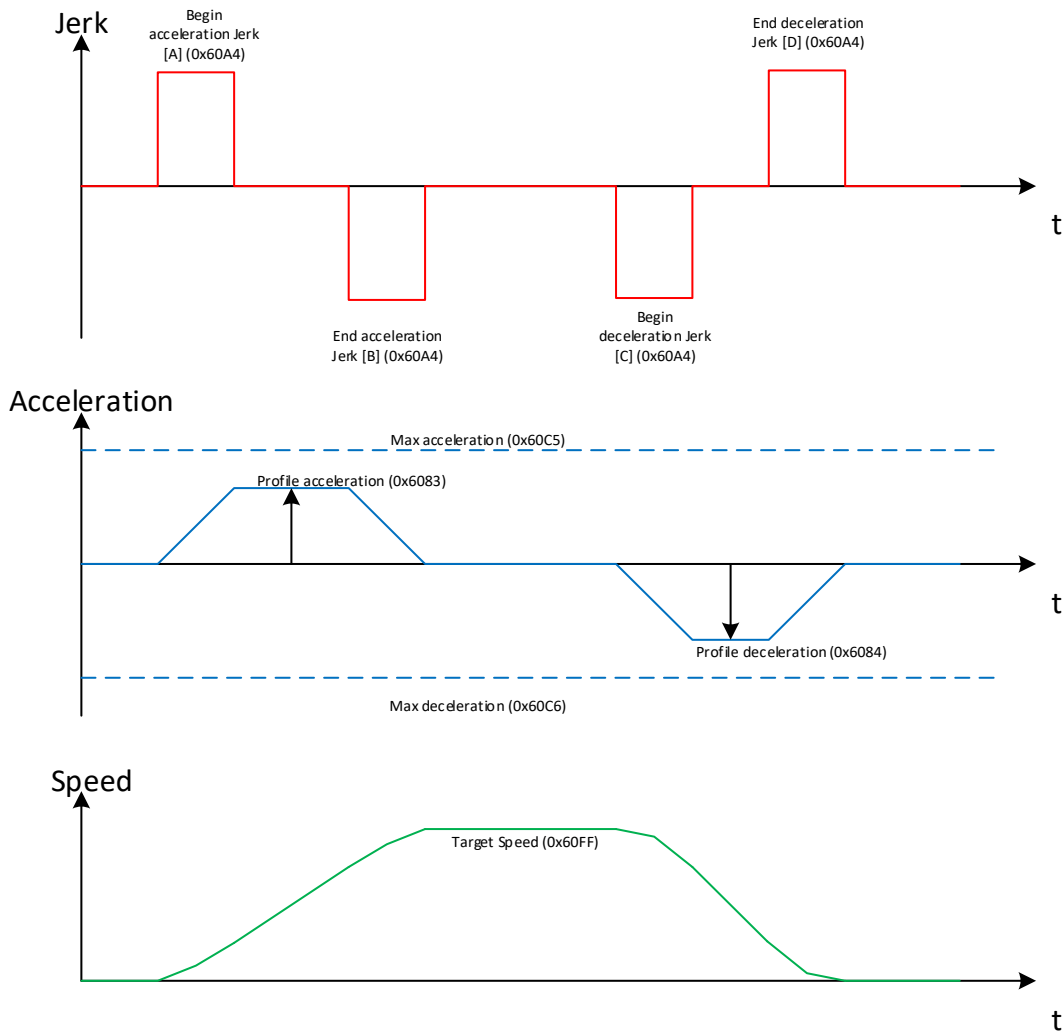
Jerk-Limited mode

In this mode, the user defines the wanted Jerk.

According the object 0x60A3 (Profile Jerk use), the acceleration Jerk can be different to Deceleration Jerk.

If Profile Jerk use (0x60A3) = 1, the Jerk in phase [A] [B] [C] and [D] is defined with Jerk 0x60A4.1.

If Profile Jerk use (0x60A3) = 2, the Jerk in phase [A] [B] is defined with Jerk 0x60A4.1. The Jerk in phase [C] and [D] is defined with Jerk 0x60A4.2.



Jerk-Limited in rate mode

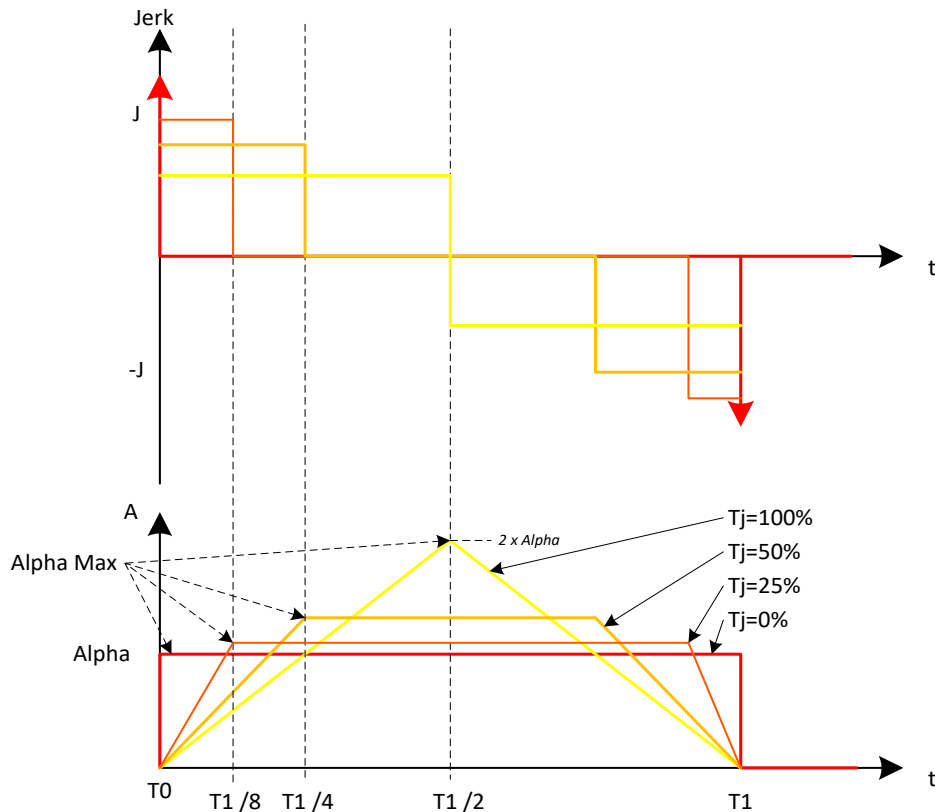
This mode is the same as Jerk-Limited mode. The only difference is the unit of the Jerk defined in object 0x60A4 is in percent (0...100).

0% mean no jerk (similar to Linear ramp)

100% is equivalent to Jerk-Free mode (Jerk increase and decrease without stabilized phase)

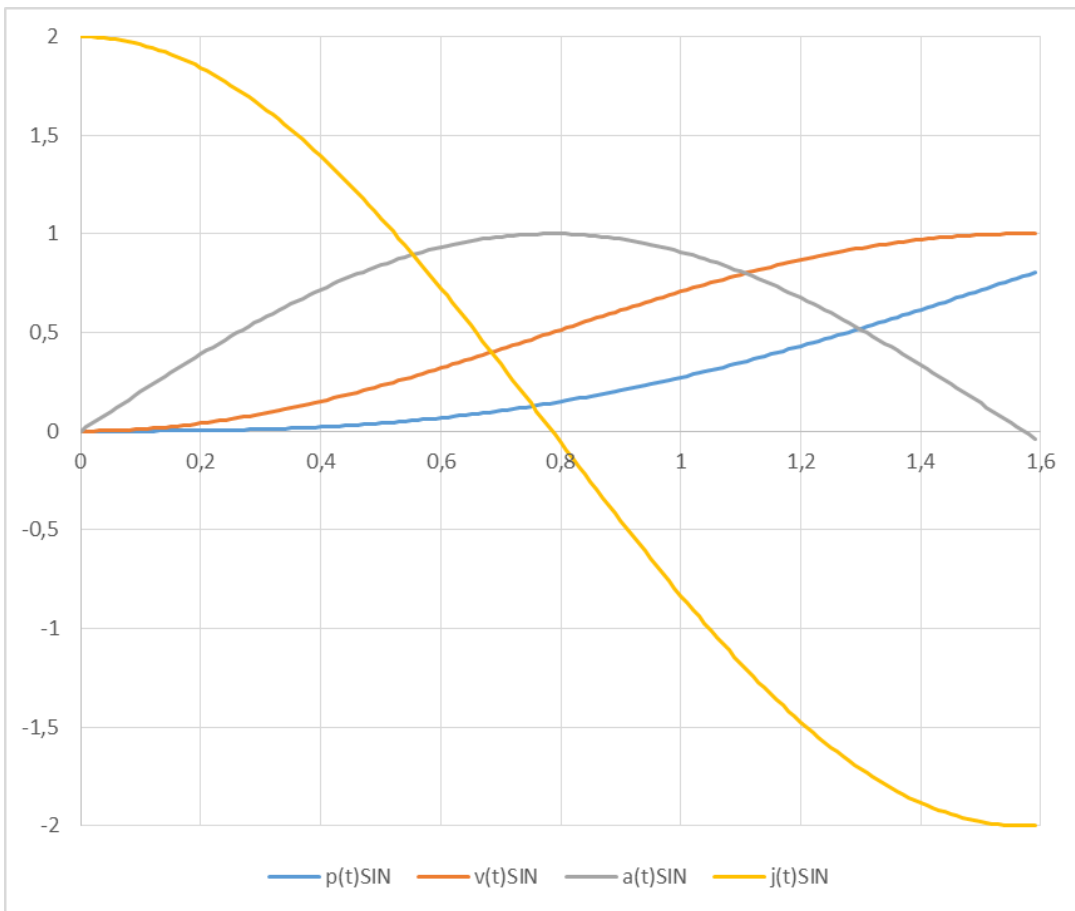
50% means:

- a positive Jerk during 25% of acceleration phase,
- A stabilized jerk during 50% of acceleration phase,
- A negative jerk during 25% of acceleration phase

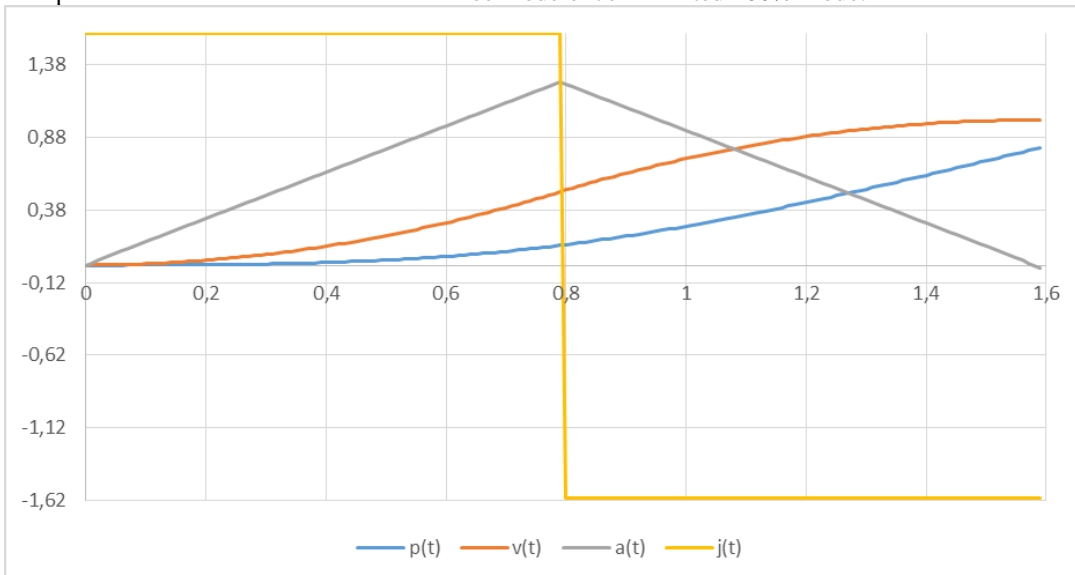


Sin² Ramp

In this phase, the acceleration follows a Sin² waveform:



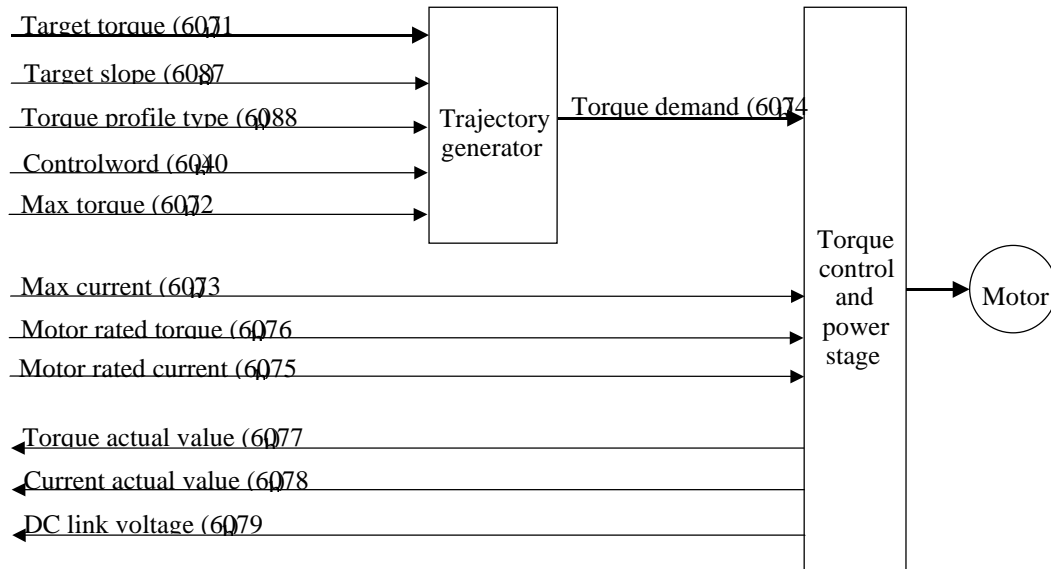
Compare to 'S' curve obtained with Jerk-Free mode or Jerk-limited 100% mode:



III.2.3 Profile torque (pt mode)

III.2.3.1 General information

The profile torque mode allows control device to transmit the target torque value, which is processed via the trajectory generator.



If the control device switches the Controlword bit 8 (halt) from 0 to 1 or from 1 to 0, then the trajectory generator ramps its control effort output down to zero, respectively up to the target torque. In both cases, the trajectory generator takes the torque.

III.2.3.2 Functional description

Control Word

15	9	8	7	6	4	3	0
See 0x6040 description	Halt	See 0x6040 description	reserved			See 0x6040 description	

The following bits in object 0x6040 (control word) have a special function:

- Bit 8 (Stop): If this bit is set to "0", the motor is started according to the specifications. When set to "1", the motor is brought to idling according to the specified values: Axis shall be stopped according to the halt option code (605Dh)
- Bit 14: Allow to acknowledge Max Speed Error. (Must have falling edge when Max Speed Error bit is set and motor speed is null)

Status Word

15	14	13	12	11	10	9	0
See 0x6041 description	reserved		See 0x6041 description	Target reached		See 0x6041 description	

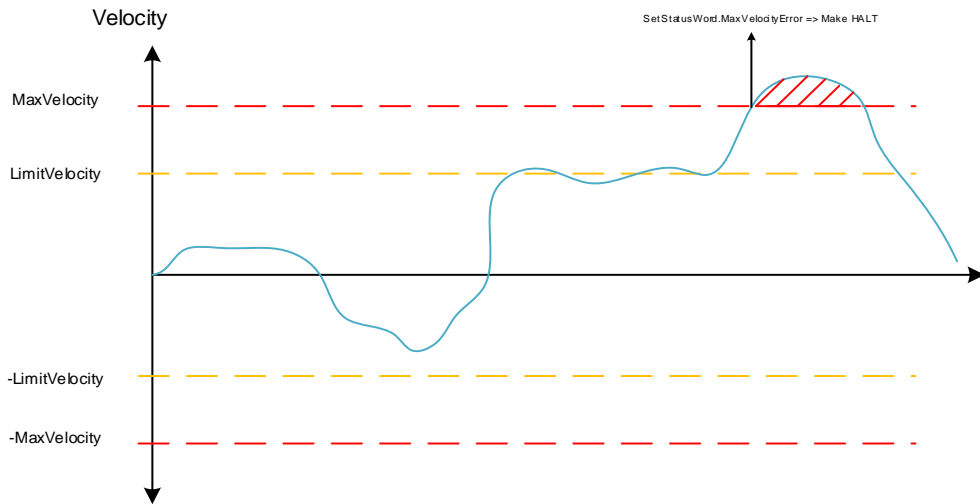
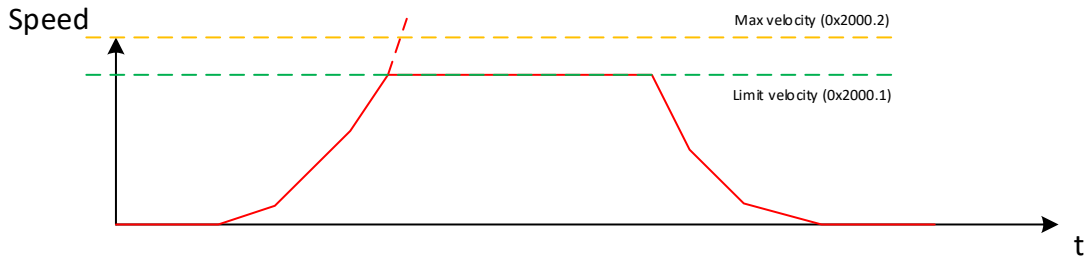
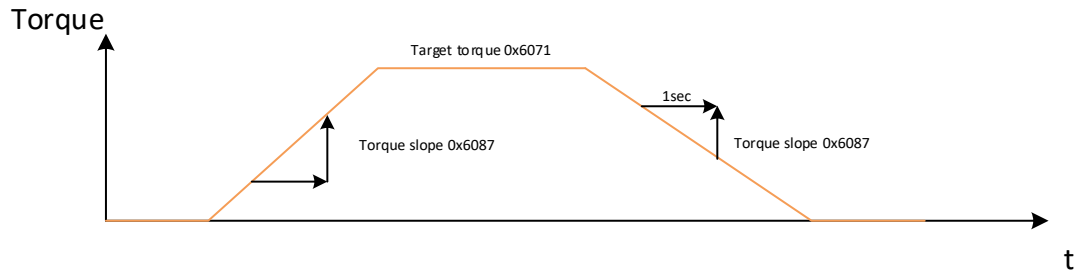
The following bits in object 0x6041 (status word) have a special function:

- Bit 10 (Target Reached): This bit in combination with bit 8 of object 6040_h(control word) indicates whether or not the specified torque has been reached (see the following table).
- Bit 14: Max Speed Error: Set when configured max speed (cf. Object 0x2000) was overpassed.

0x6040 Bit 8	0x6041 Bit 10	Description
0	0	Specified torque not attained
0	1	Specified torque attained
1	0	Axis accelerated
1	1	Speed of axis is 0

Parameters

The following diagram shows parameters used to establishing the profile.

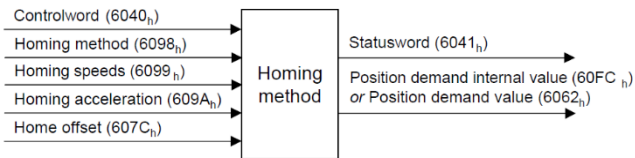


III.2.4 Homing (h mode)

III.2.4.1 General information

The purpose of the reference run (homing method) is to synchronize the motor controller with the encoder index of the motor or position switch in a system.

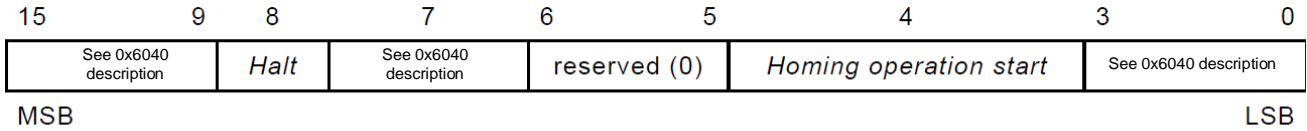
There are various methods of achieving this using limit switches at the ends of travel or a home switch (zero-point switch) in mid-travel, most of the methods also use the index (zero) pulse train from an incremental encoder. Another method is to detect the blocking current.



The user may specify the speeds, acceleration and the method of homing. There is a further object home offset, which allows the user to displace zero in the user's coordinate system from the home position.

III.2.4.2 Functional description

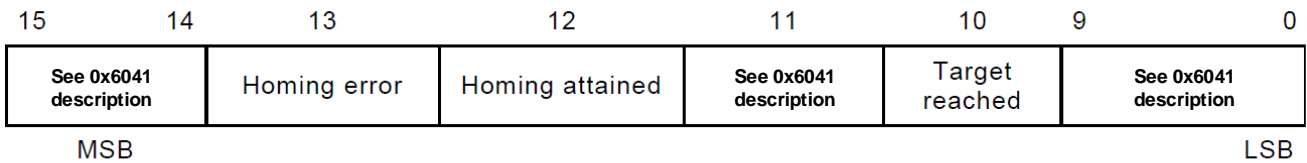
Control Word



The following bits in object 0x6040 (control word) have a special function:

- Bit 2 is used to trigger a quick stop. If it is set to "0", the motor carries out a quick stop with the ramp set in object 0x6085. Then the motor controller changes to the "Switch on disabled" state (0x6040).
- Bit 4: If the bit is set to "1", the referencing is started. This is set forth until either the reference position is reached or bit 4 is set to "0" again.

Status Word

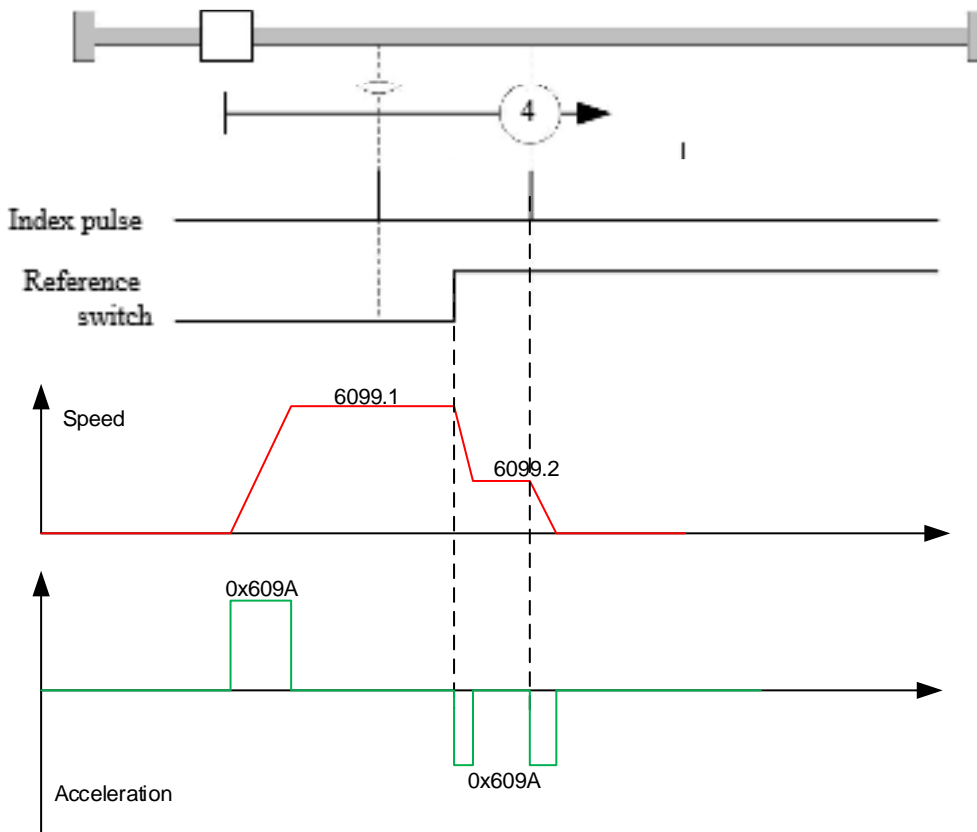


The following bits in object 0x6041 (status word) have a special function:

Bit 13	Bit 12	Bit 10	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 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

Parameters

The figure shows the speed of the homing using method 4 as an example:



Homing on block

The homing method is written into object 0x6098 as a number and defines whether referencing should be performed on a switch flank (rising/falling), a current threshold for block detection or an index pulse is referenced, or in which direction the reference run should start. Methods that use the index pulse of the encoder are within the number range 1 to 14, 33 and 34. Methods that do not use the index-pulse of the encoder are between 17 and 30, but their travel profiles are identical with those of the methods 1 to 14. Methods that do not use a limit switch, and instead travel against a block is to be detected, must be called up with a minus in front of the method number. (Method -1, -2, -17, -18).

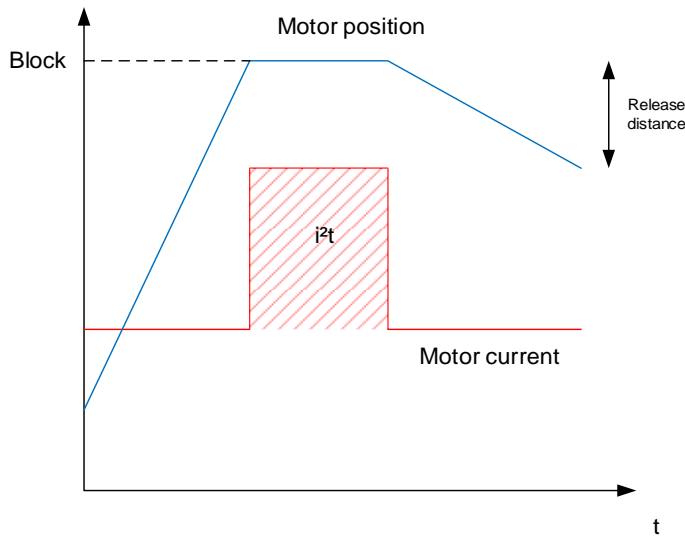
Method 35 is obsolete and equivalent to set current position to zero and subtract the Home offset (0x607C). Method 37 is to set position from the coder absolute position.

For the following diagrams, the negative movement direction is to the left. The limit switch is located in front of the mechanical block in each case, and the reference switch (home switch) is between the two limit switches. The index pulses come from the encoder, which is connected with the motor shaft and motor controller.

For methods that use homing on block, the same illustrations apply as for the methods with limit switch. New illustrations are not shown as nothing changes except for the missing limit switches. In this case, the limit switches have to be replaced by a mechanical block in the illustrations.

Homing block

"Homing on block" works like every other homing method except for positioning, a block (mechanical end stop) is used instead of a limit switch. Three settings need to be set:



- Object 0x2300.1: INominal (mA)
- Object 0x2300.2: Time (ms)
- Object 0x2300.3: I_{max} (Per Thousand of INominal)

These parameters are used when overcurrent is used to detect Left/Right home position. The detection method is done by detecting a blocked motor $\Rightarrow I^2t$

When $I^2t > (\text{Nominal} * I_{\text{max}}\%)^2 * \text{Time}$ then we consider the motor blocked.

- Object 0x2300.4: Release distance

Distance in position user defined unit parse in reverse sense after current limit detection (method -1, -2, -17, -18 only)

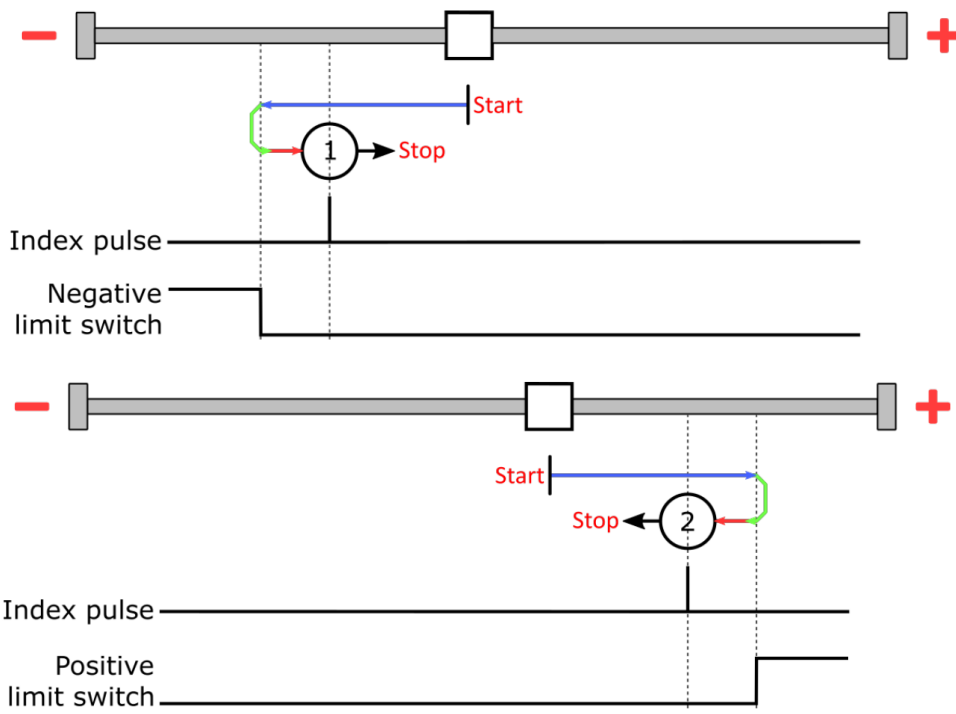
Method overview

Methods 1 to 14, and 33 and 34 use the index pulse of the encoder.

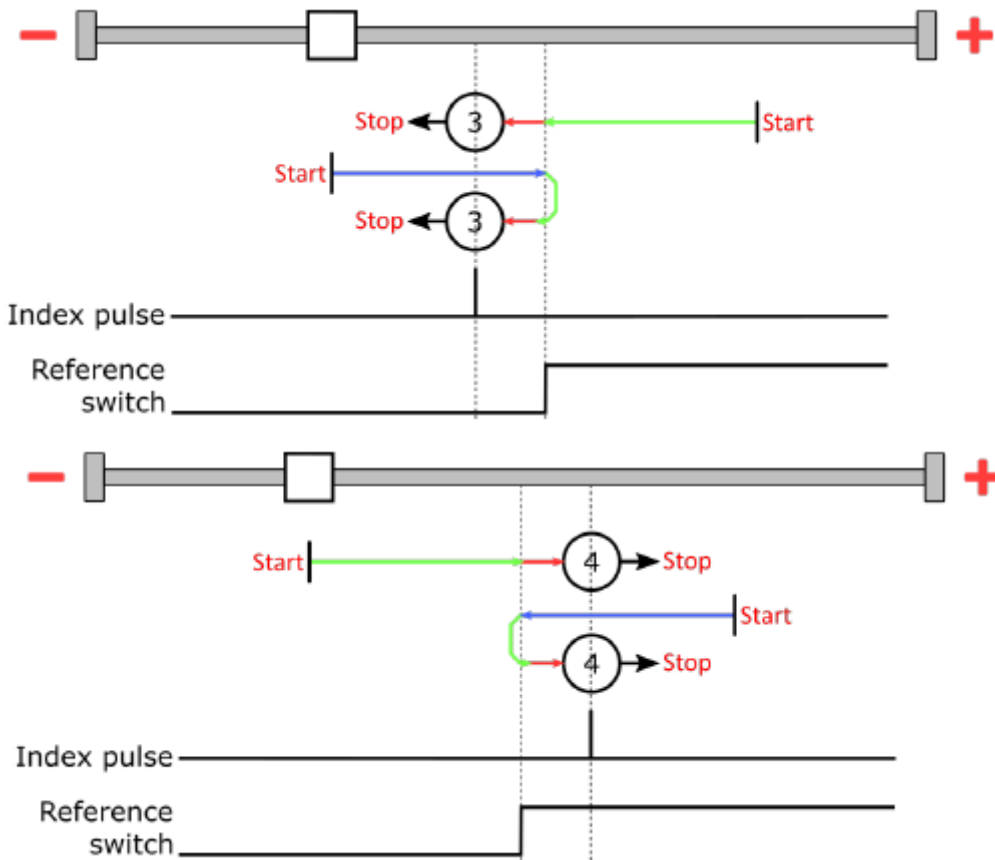
Methods 17 to 32 are identical with the methods 1 to 14 with the exception that referencing is only performed on the limit or home switch and not on the index pulse.

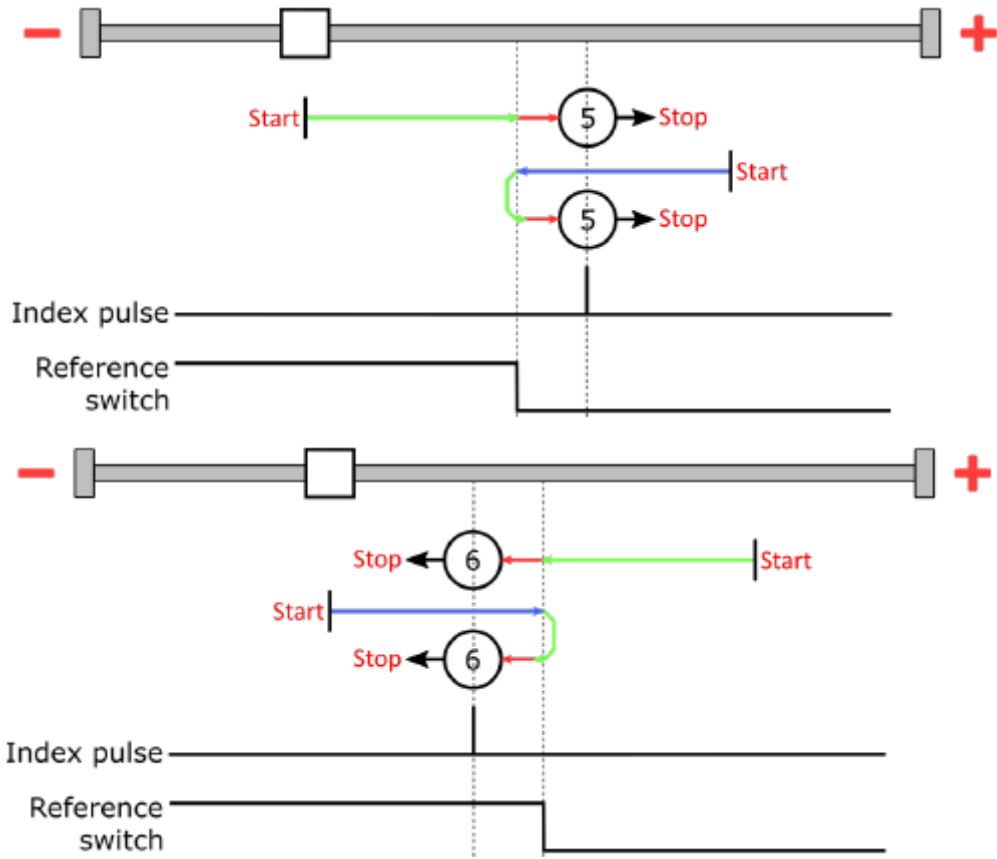
- Methods 1 to 14 contain an index pulse (-1 and -2 for OverCurrent limit)
- Methods 15 and 16 do not exist
- Methods 17 to 30 do not have an index pulse (-17 and -18 for OverCurrent limit)
- Methods 31 and 32 do not exist
- Methods 33 and 34 reference only to the next index pulse
- Method 35 references to the actual position (Will become Zero position)
- Method 37 references to the position sensor information

Methods 1 and 2

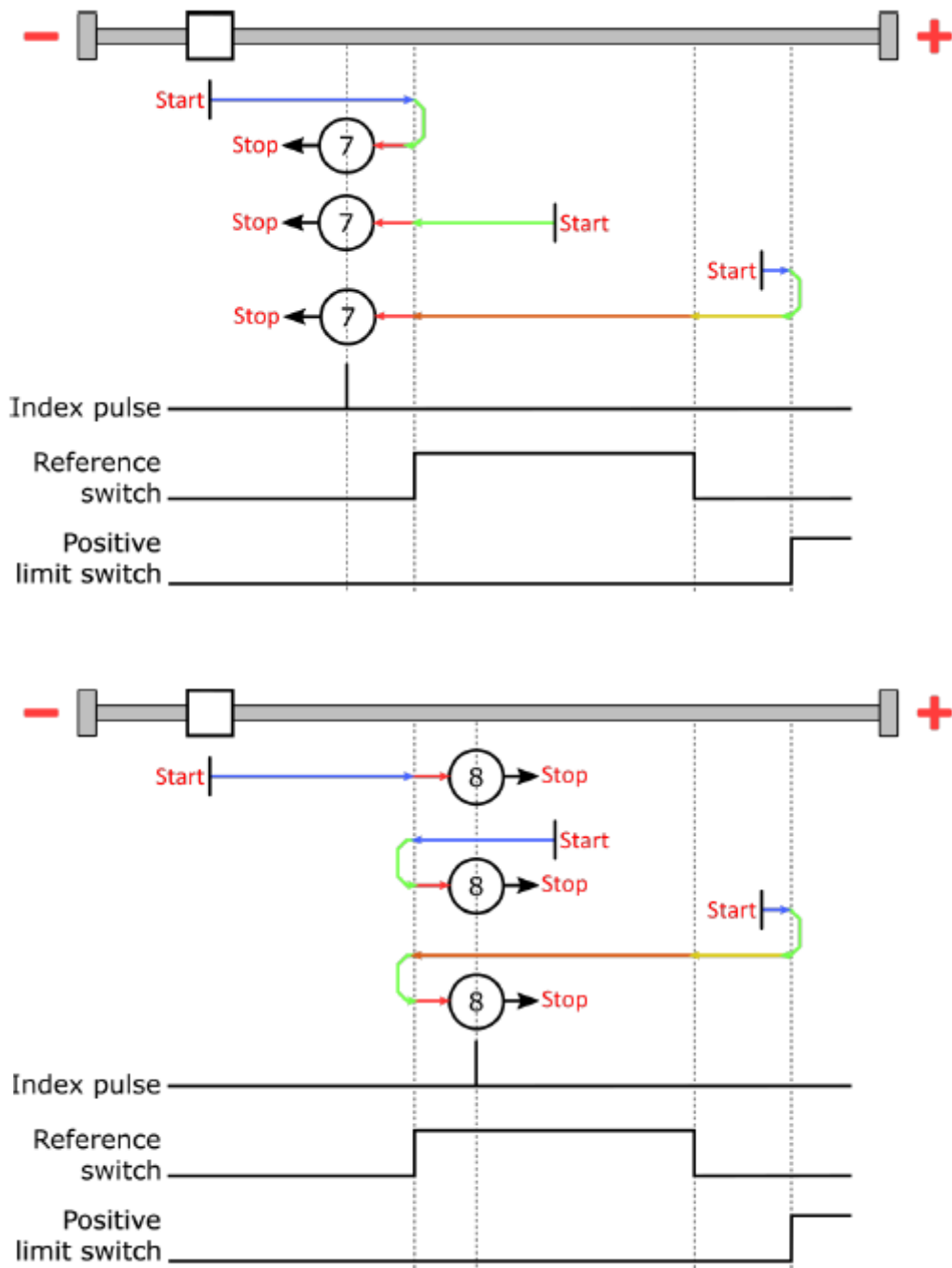


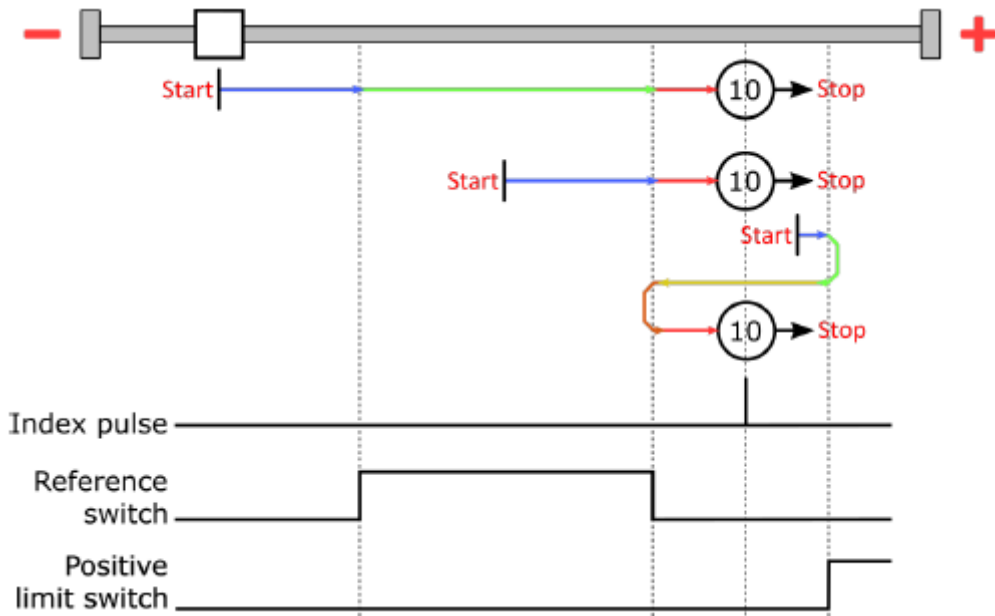
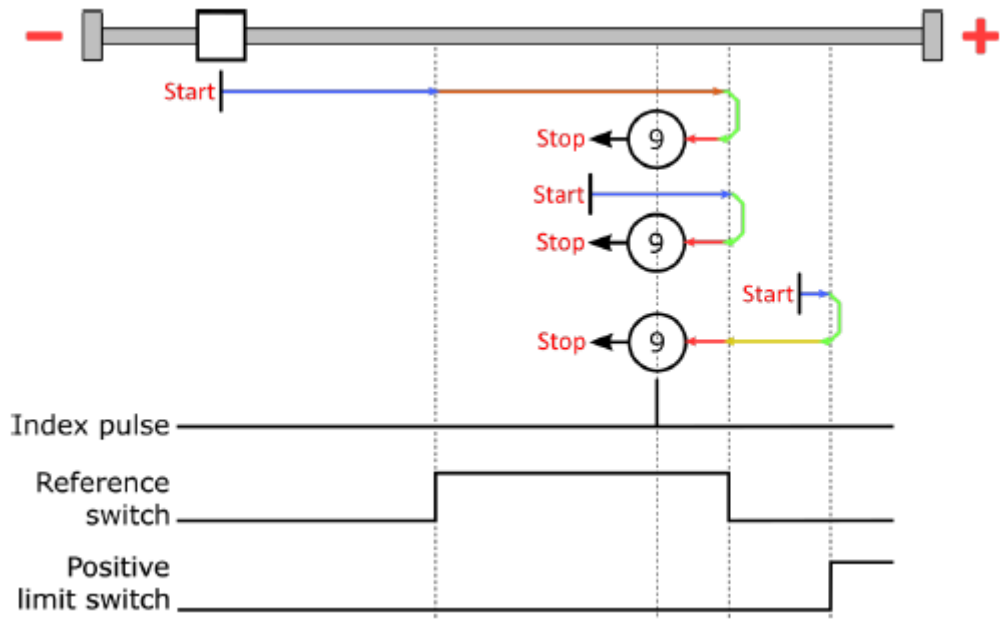
Method 3 to 6

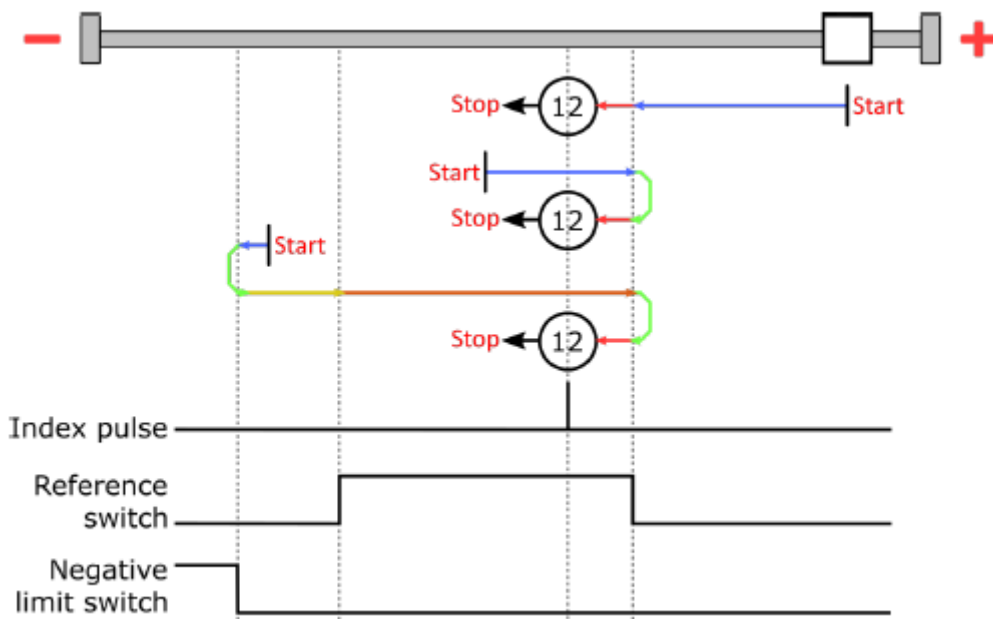
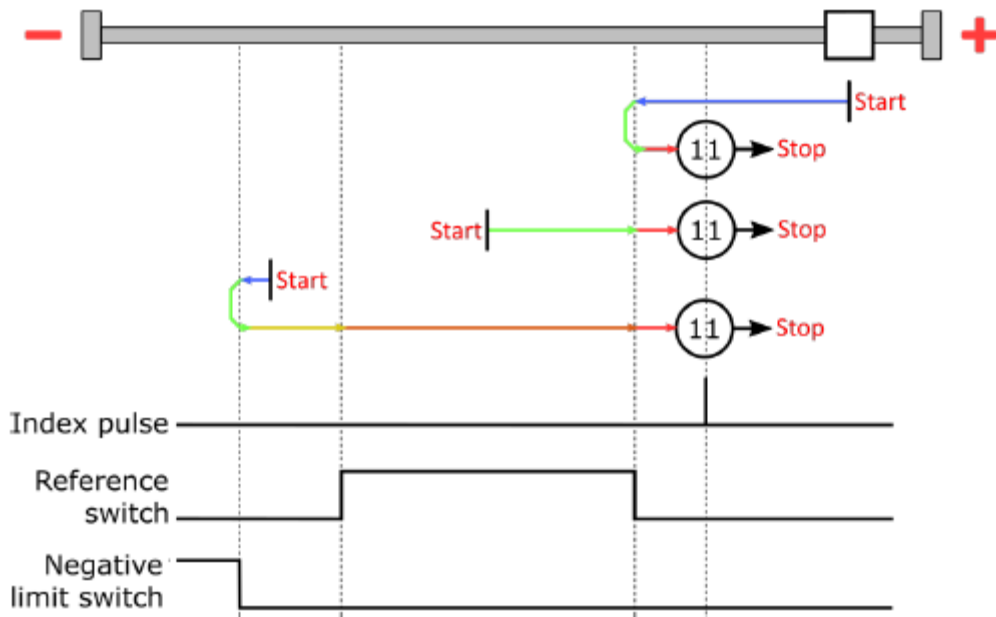


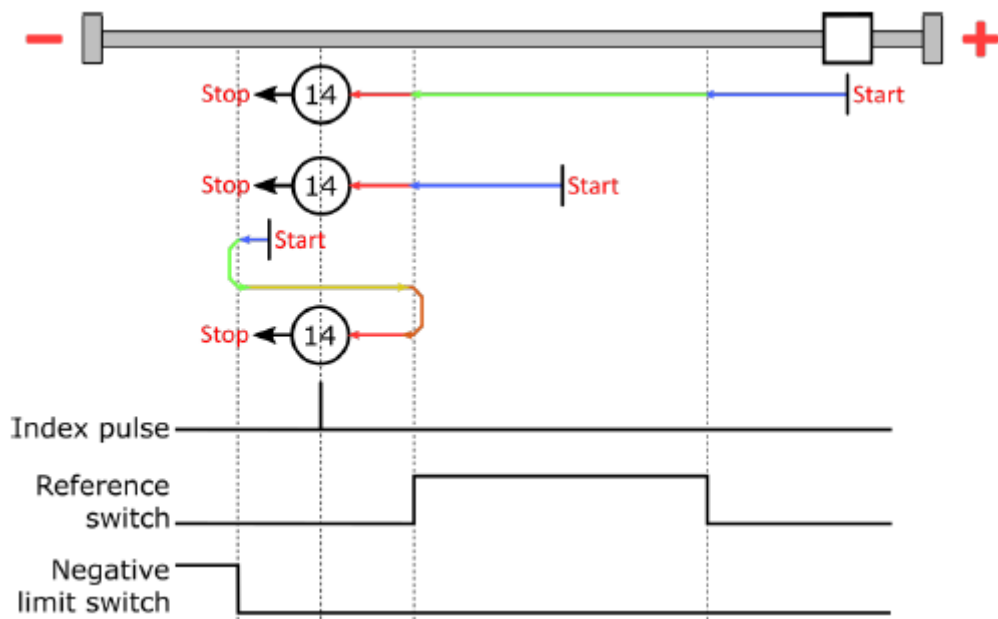
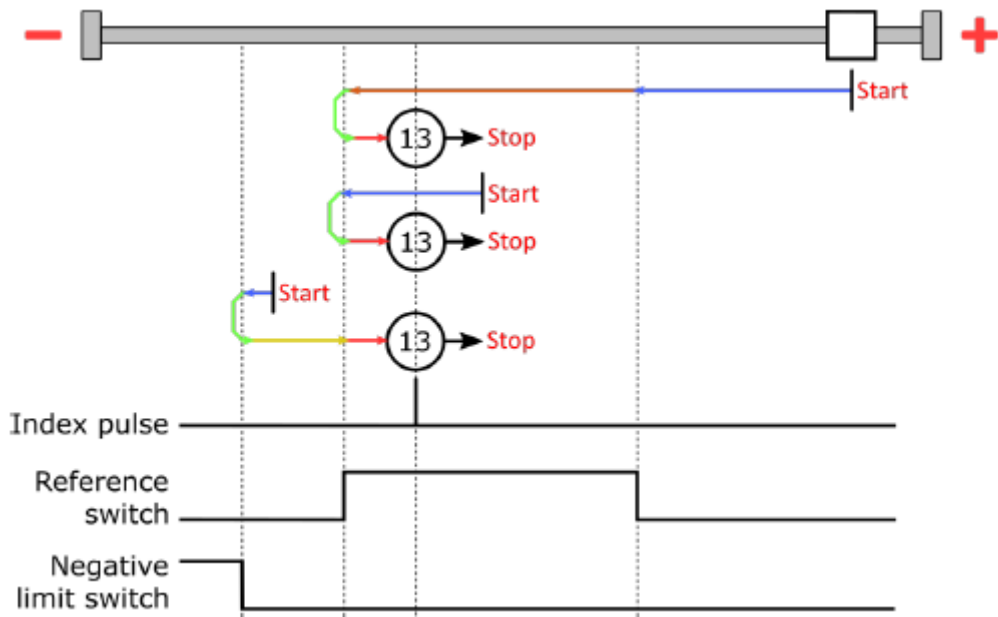


Methods 7 to 14

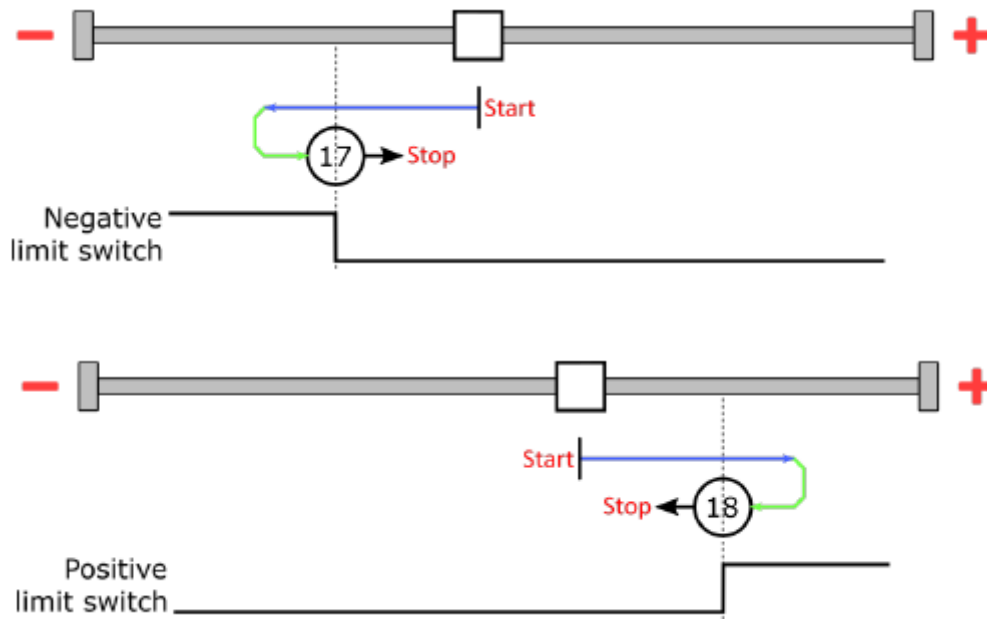








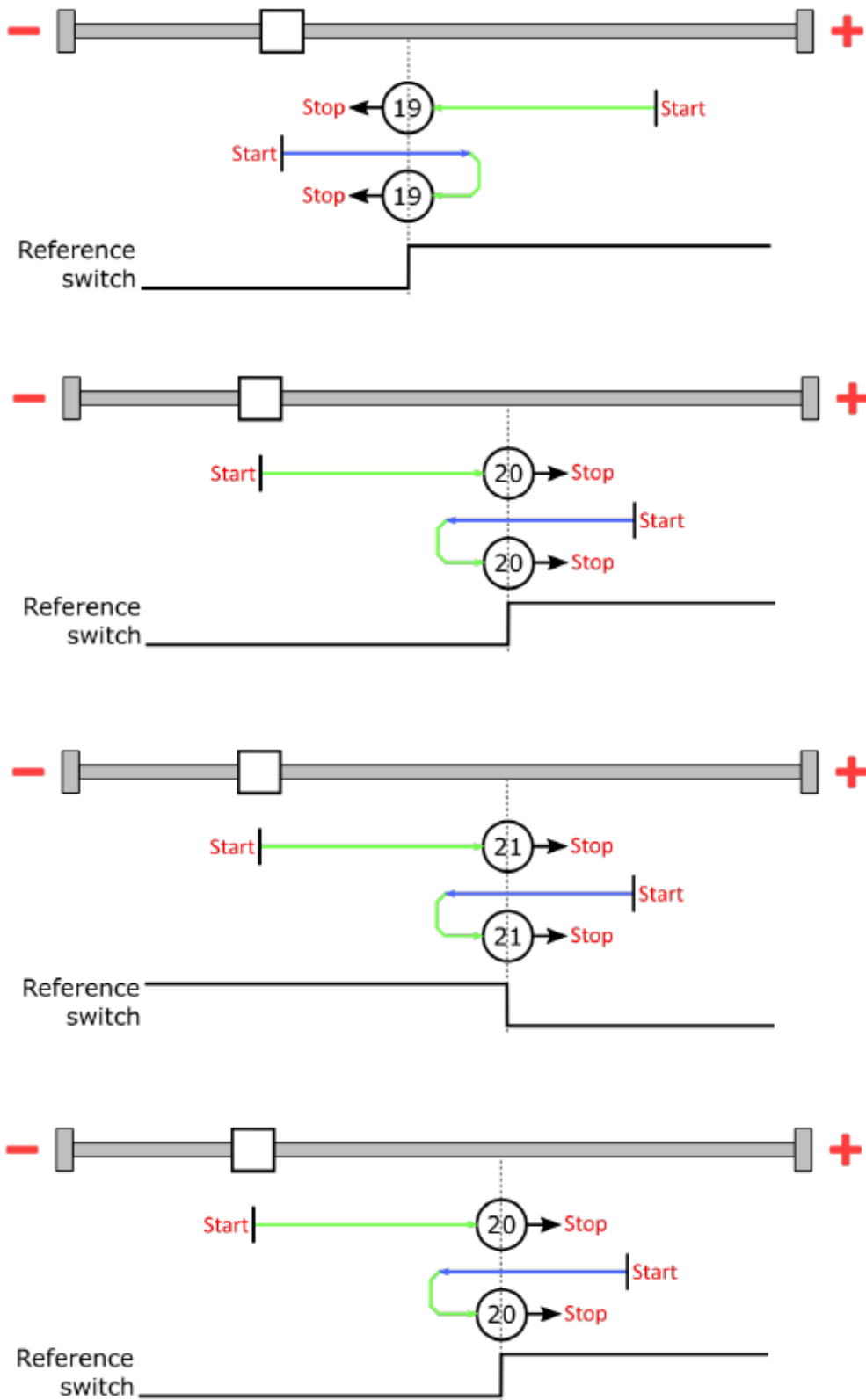
Methods 17 to 18



Methods 17 is similar to method 1 but without index pulse.
Method 18 use the positive switch

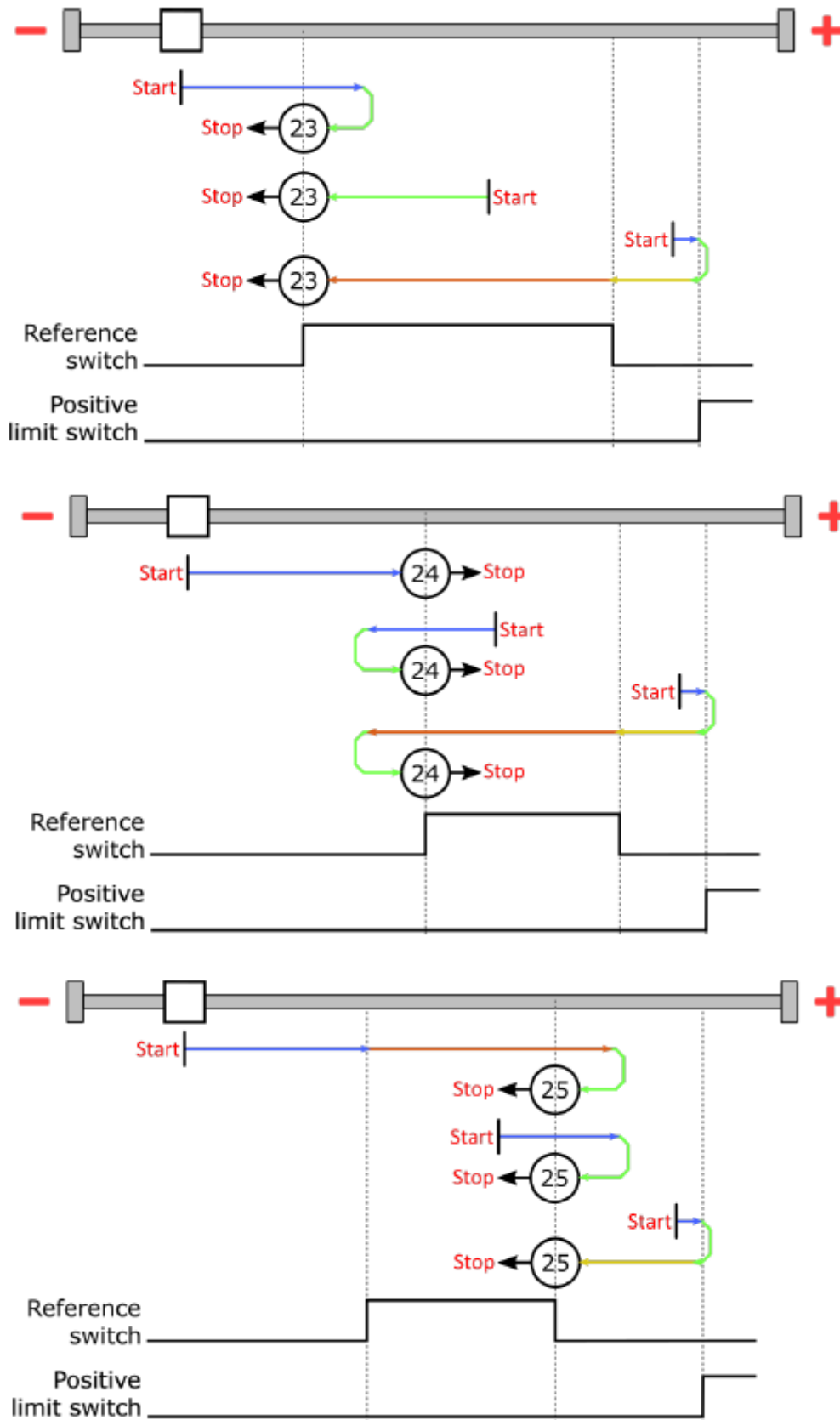
Methods 19 to 22

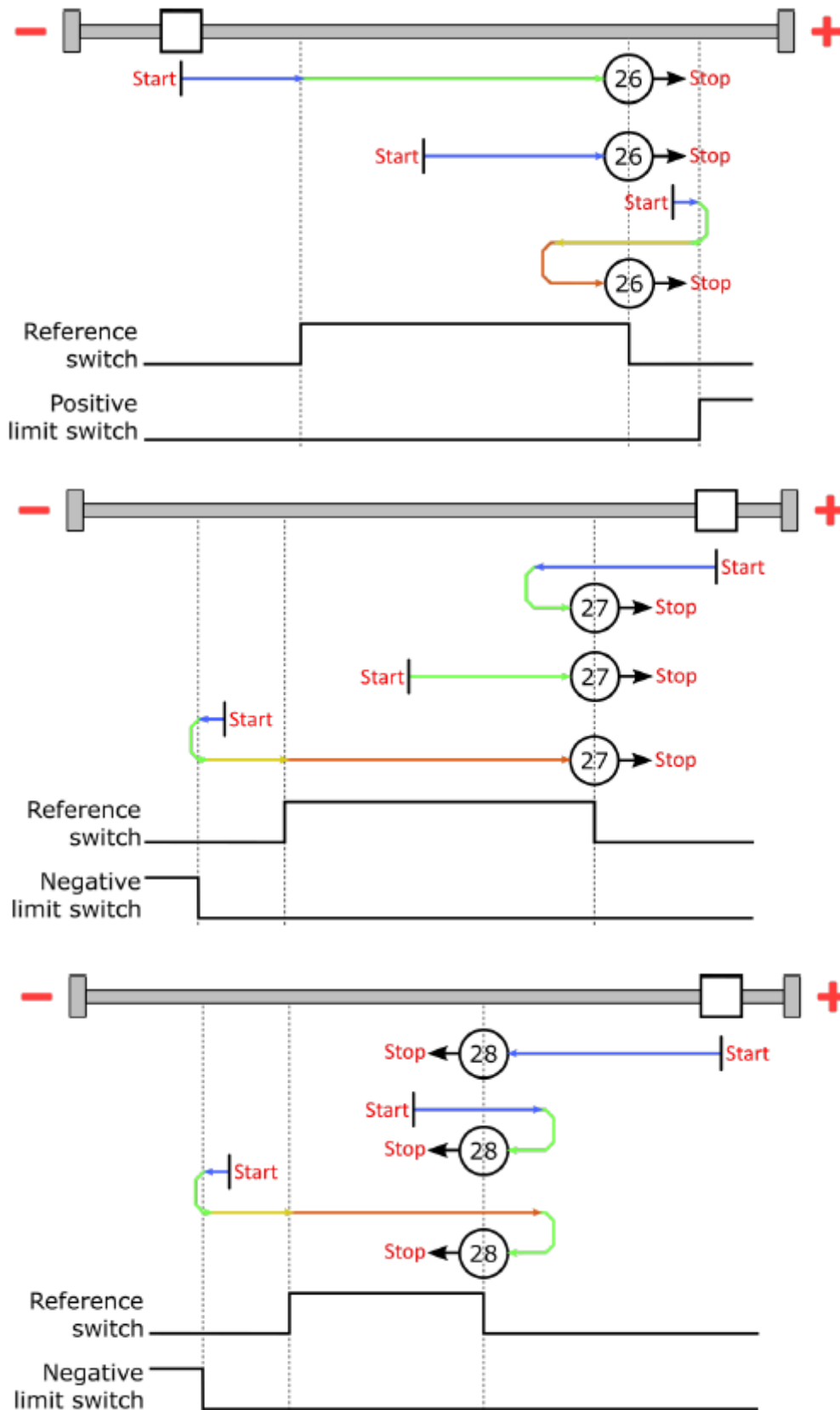
Methods are similar to method 3 to 6, but without stop on index pulse.

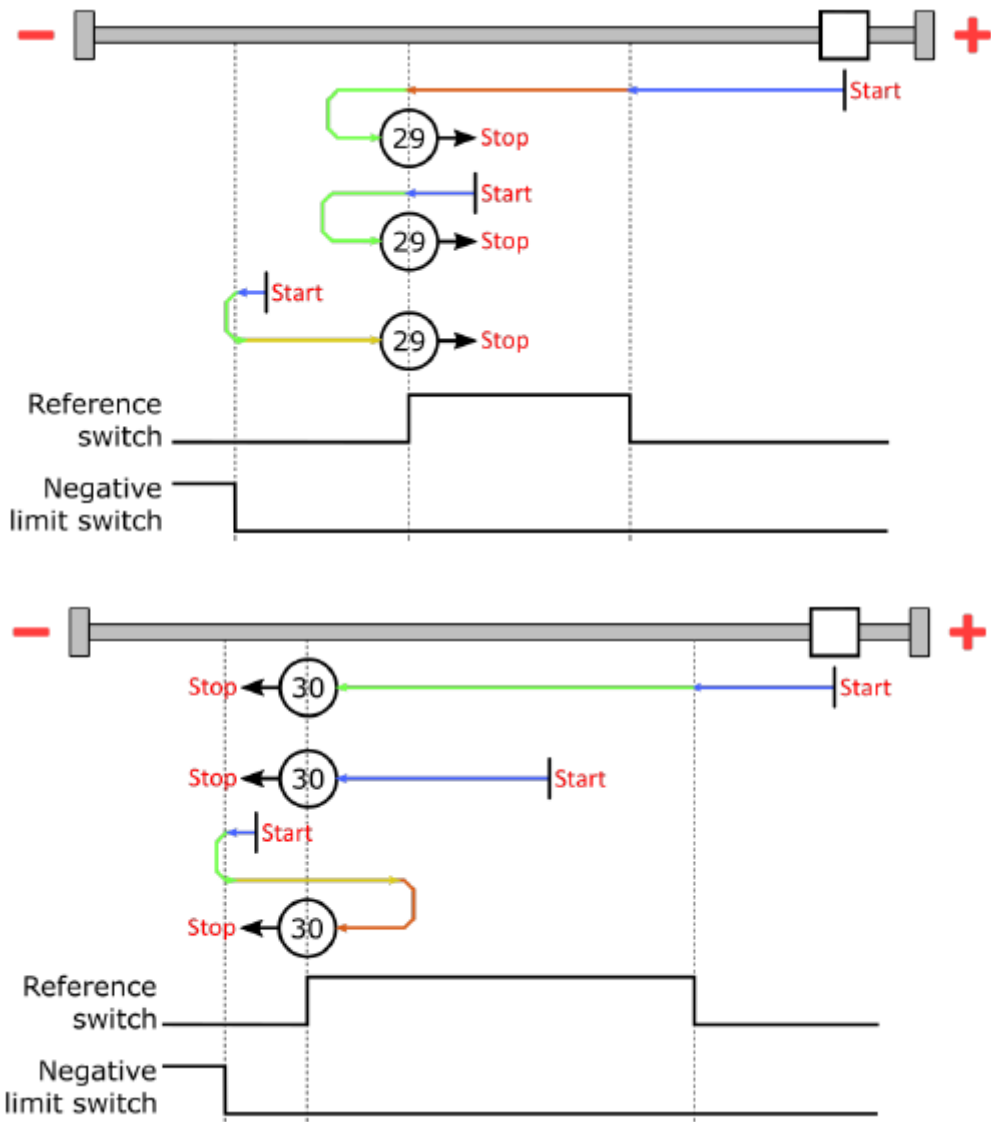


Methods 23 to 30

Methods are similar to method 7 to 14, but without stop on index pulse.

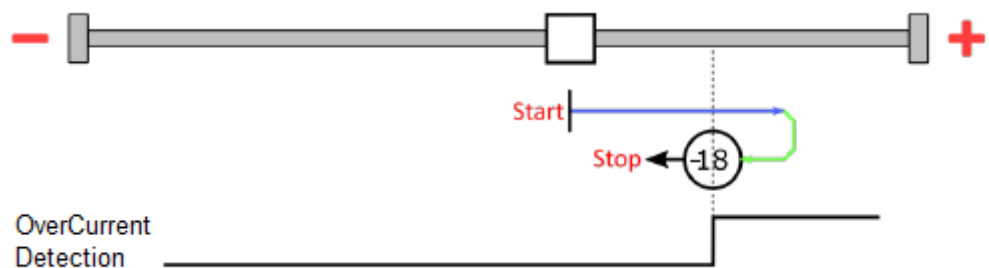
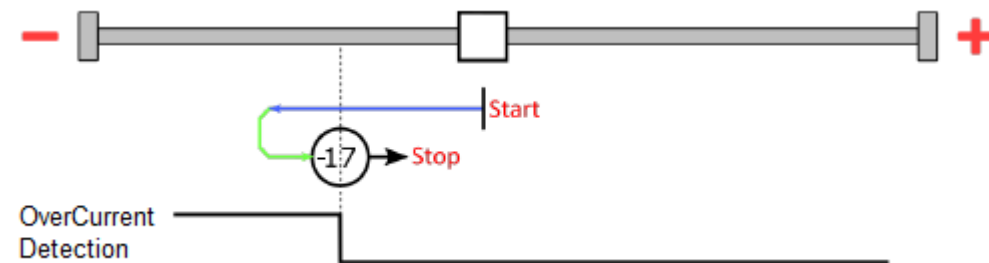
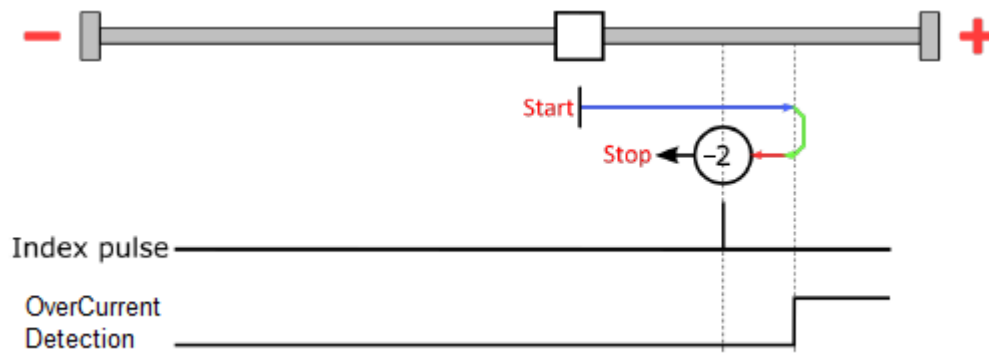
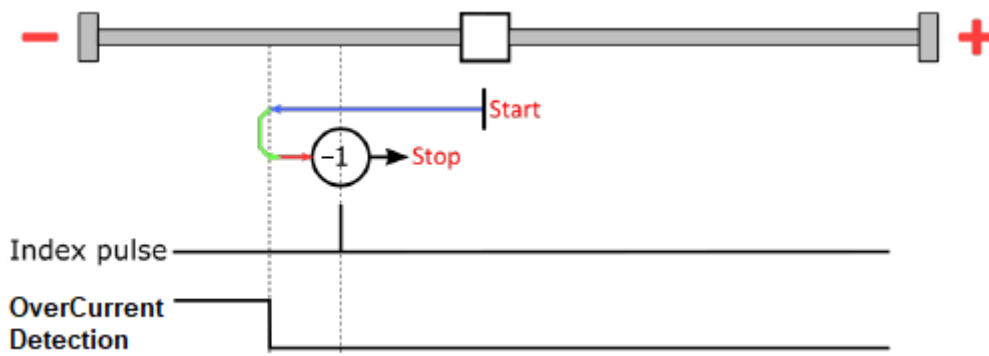






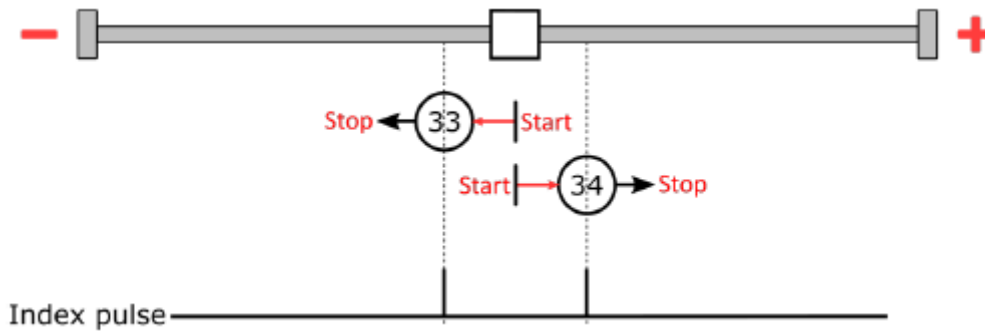
Methods -1, -2, -17, -18

These methods are similar to the opposite number method but use block current detection instead of Limit switch detection.



Methods 33 and 34

Reference the next index pulse.
 For these methods, referencing is only to respective next index pulse:



Method 35

References to the actual position.
 For this mode it is not necessary to switch the DS402 Power state machine up to the status "Operation Enabled".
 This operation corresponds to set current position to zero (Or -HomeOffset if <> 0)

Method 37

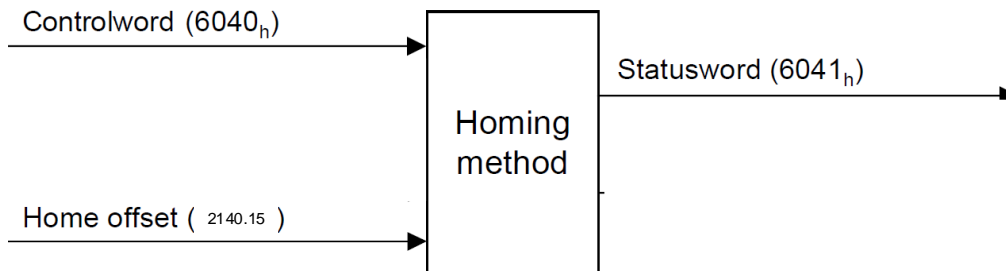
References to the position sensor information: Index signal is taken as the zero position reference.
 For this mode it is not necessary to switch the DS402 Power state machine up to the status "Operation Enabled".
 Note: For QEP sensor, the TopZ signal must be crossed else there is no sense!

III.2.5 Homing Master (hm mode)

III.2.5.1 General information

The purpose of the reference run (homing Master method) is to synchronize the motor controller with the encoder index of the motor or position switch in a system. The Master is the Auxiliary coder. SMD not drive the master, but get its position

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. Another method is to detect the blocking current.



The user may specify the method of homing. There is a further object home offset, which allows the user to displace zero in the user's coordinate system from the home position.

Available methods are the following:

Methods 1 to 14, and 33 and 34 use the index pulse of the encoder.

Methods 17 to 32 are identical with the methods 1 to 14 with the exception that referencing is only performed on the limit or home switch and not on the index pulse.

- Methods 1 to 14 contain an index pulse
- Methods 15 and 16 do not exist
- Methods 17 to 30 do not have an index pulse
- Methods 31 and 32 do not exist
- Methods 33 and 34 reference only to the next index pulse
- Method 35 references to the actual position
- Method 37 references to the position sensor information

The Homing method are the same as for the normal Homing Mode. Refer to this chapter.

III.2.6 Interpolated position (ip mode)

III.2.6.1 General information

The interpolated position mode is used to control multiple coordinated axes or a single axis with the need for time-interpolation of set-point data. The interpolated position mode normally uses time synchronisation mechanisms for a time coordination of the related drive units.

For Interpolated Position mode, it could be usable that the controller is synchronized to the SYNC object. This SYNC object must be sent by the higher-order controller at regular time intervals.

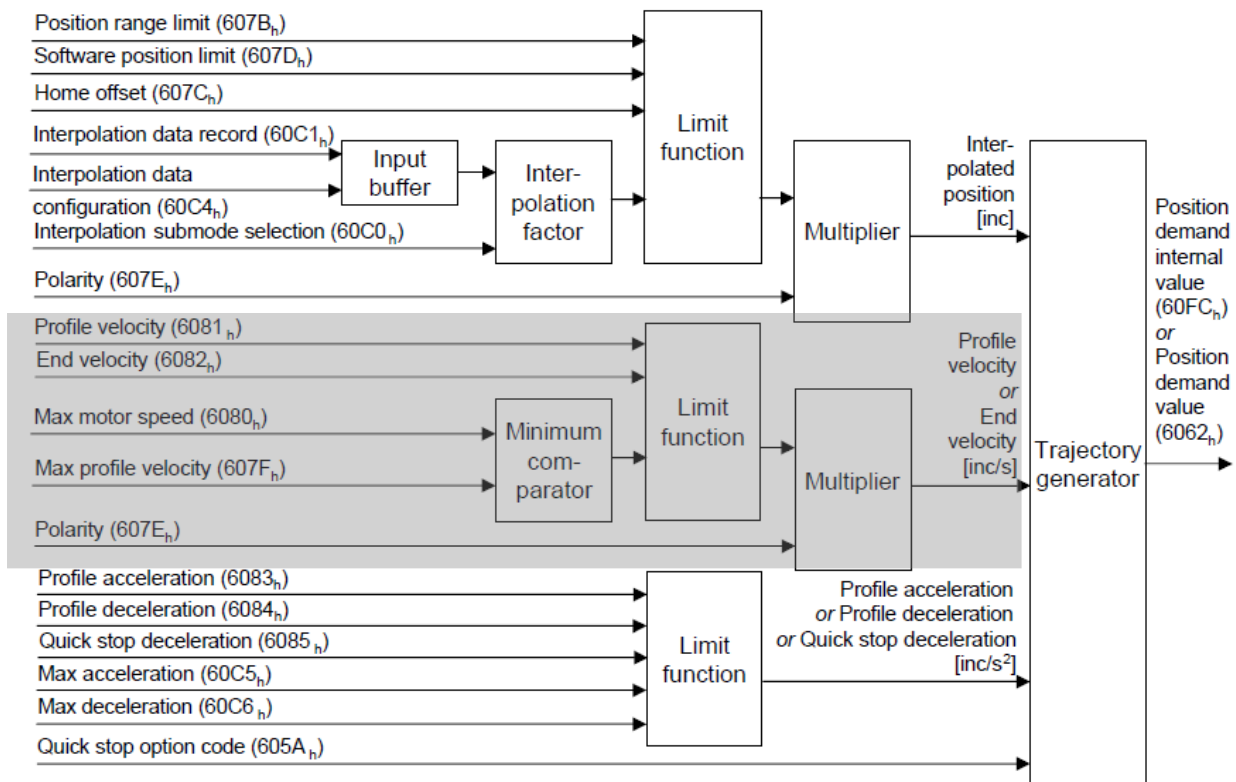


Figure 37 – Interpolation controller

For synchronous operation, the interpolation cycle time is defined by the object interpolation time period. Time synchronisation may be done by network dependent mechanisms (SYNC frame). Each synchronisation cycle actuates the next data record if a valid data record is available.

For asynchronous operation, the interpolation time (for each time slice), may be included in the interpolation data record. If this is so, then the units for the interpolation time are still specified by the interpolation time index as for synchronous operation. The next data record shall be actuated as soon as the interpolation time expires and a valid data record is available.

The interpolated position mode allows the control device to transmit a stream of interpolation data with either an implicit or explicit time reference to a drive unit. The interpolation data may be sent in bursts rather than continuously in real time. The maximum size of the input buffer may be read by the control device using the interpolation data configuration. The actual buffer size may be both written and read by the control device using the interpolation data configuration. The buffer size is the number of interpolation data records which may be sent to a drive to fill the input buffer and it is not the size in bytes.

The interpolation data buffer is implemented as a FIFO. The definition of a valid data record for each type of buffer shall be as follows:

- For the FIFO implementation, a valid data record is one that has not been actuated yet.

- For the Ring implementation, all data records within the actual buffer size are treated as valid data records, so interpolation data will continue to be actuated while ip enable is true.

The interpolation algorithm is defined in the interpolation sub mode select. Linear interpolation is the default interpolation method. This requires only one interpolation data item to be buffered for the calculation of the next demand value. For each interpolation cycle, the drive calculates a position demand value by interpolating positions over a period of time.

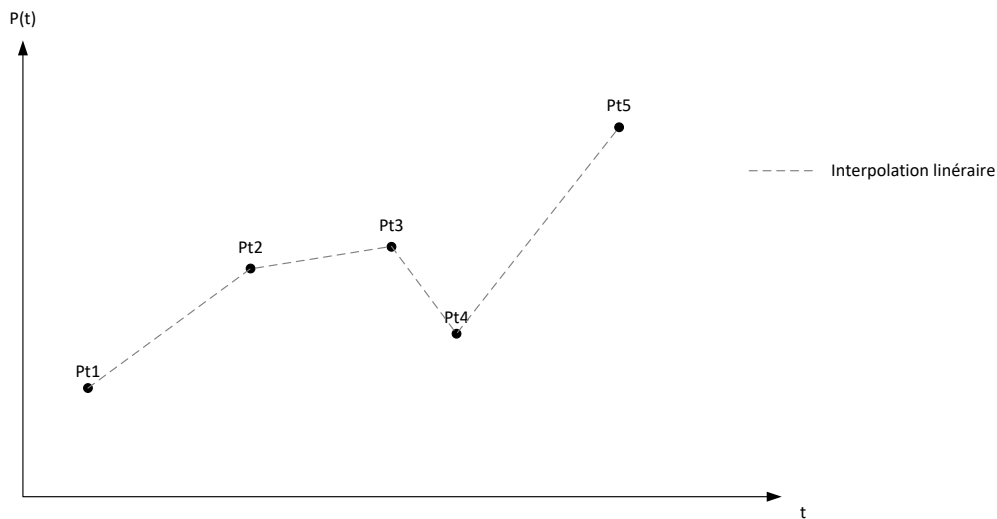
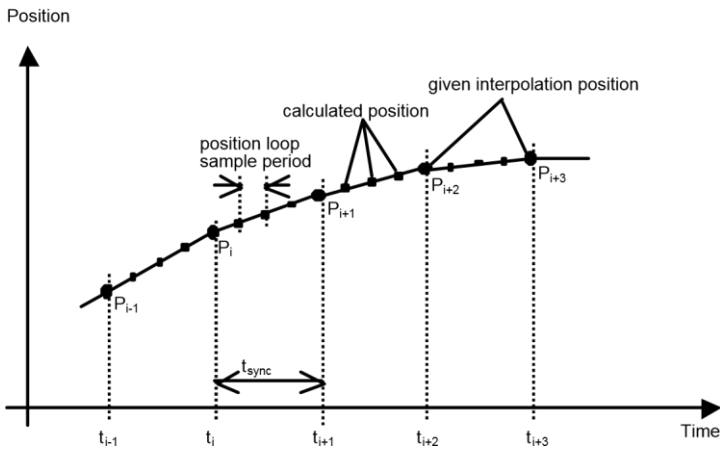
III.2.6.2 Functional description

Linear interpolated position mode

In this mode, the motor move from the initial position to the target position (Absolute or relative) under the specified time.

Then the Set point to place in the buffer (0x60C1) is composed like following:

- Target Position (P.u.d.) – 32bits
- ControlWord (0 = Absolute, 1 = Relative) – 32bits
- Period – 32bits - Only if 0x60C2.01 = 0. Unit = $10^{(0x60C2.2)}$ seconds

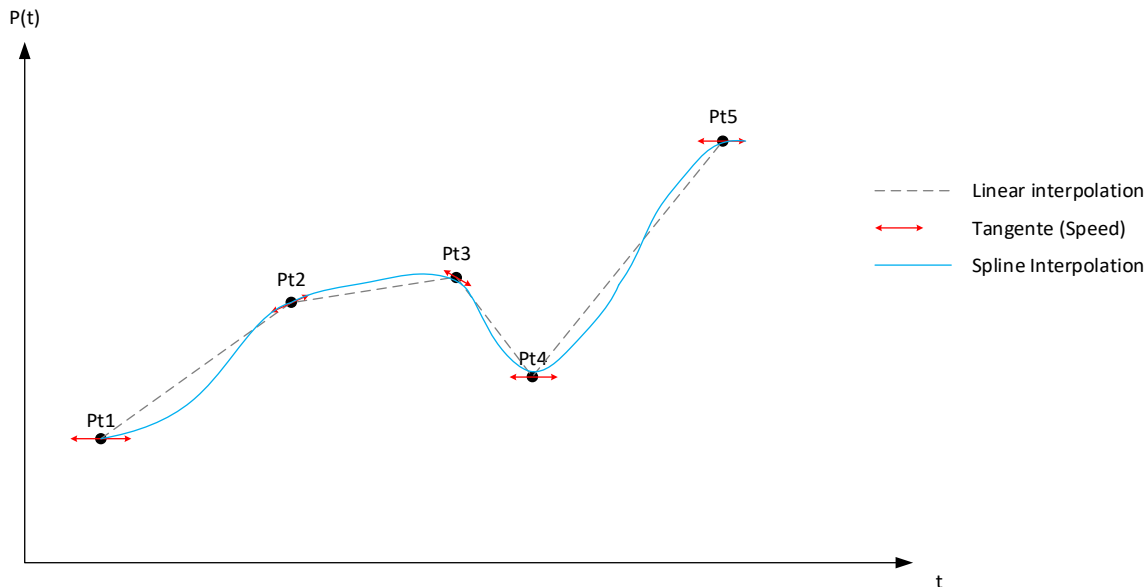


Spline interpolated position mode

In this mode, the motor move from the initial position to the target position (Absolute or relative) under the specified time with a specific end speed.

Then the Set point to place in the buffer (0x60C1) is composed like following:

- Target Position (P.u.d) – 32bits
- ControlWord (Bit0: 0= Absolute; 1 = Relative; Bit1: 0 = Manual Speed, 1: Automatic Speed = Means Speed according Point n-1 and n+1)
- Period – 32bits - Only if 0x60C2.01 = 0. Unit = $10^{(0x60C2.2)}$ seconds
- End Speed (V.u.d) – 32bits (If ControlWord is Automatic Speed, set to 0)



Buffer strategies

The content of the buffer items is only be accessed via the interpolation data record. (0x60C1)

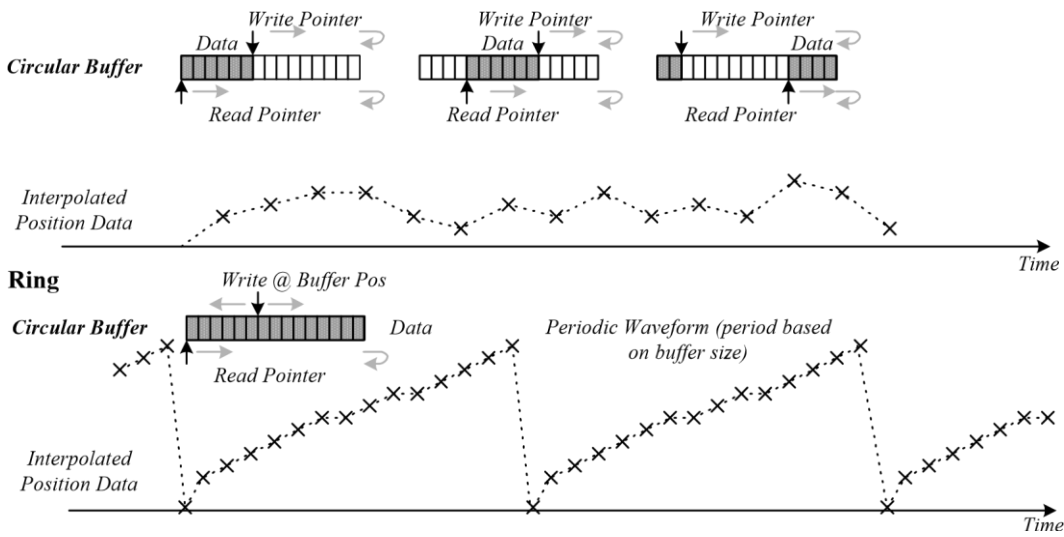
Two mode are possible: first-in-first-out (FIFO) structures or ring buffers are used as input buffers.

In all case, user MUST write the index 1 of the Set point in the last time. Because these writes trig the push of the all set-point into the internal buffer (Fifo or Ring)

- **FIFO:** If the buffer is organised as FIFO, every new received interpolation data record is placed at the end of the queue, and the device takes the next data record from the top of the queue. When the last item of a data record is stored, the buffer pointer is incremented in order to point to the next buffer position. For this buffer principle, the object buffer position does not have any influence.
- **Ring buffer:** If the buffer is structured as a ring, the control device may place an interpolation data record into any valid position in the ring by changing the pointer defined in buffer position (0x60C4.04). Without changing the buffer position, all data records will be written at the same location. The drive reads the next entry out of the buffer by an internal ring pointer. It is set to the first data record with a clear buffer, and after the reorganisation of the input buffer.

The ring buffer may be used to achieve a periodic motion and all data records in the actual data buffer are considered to be valid. If no new data is written to the FIFO, then the motion shall halt and interpolation should become inactive at the last valid data point.

FIFO



Control Word

15	9	8	7	6	5	4	3	0
See 0x6040 description	Halt	See 0x6040 description	reserved (0)	Enable interpolation	See 0x6040 description			

The following bits in object 0x6040 (control word) have a special function:

- Bit 4 enables interpolation when set to "1".
- Bit 8 (Halt): At the transition from "1" to "0" the motor start movement. At the transition from "0" to "1" the motor decelerates and will come to a halt. The deceleration is depending on the settings in the "Halt Option Code" in object 0x605D.

Status Word

15	14	13	12	11	10	9	0
See 0x6041 description	reserved	<i>ip</i> mode active	See 0x6041 description	Target reached	See 0x6041 description		
MSB	LSB						

- Bit 10: Target position not (yet) reached: This bit is set to "1" when the target position was reached (if the halt bit in the ControlWord "0") or the axle has velocity 0 (if halt bit in last ControlWord was 1)
- Bit 12 (*ip* mode active): This bit will be set to "1" if the interpolation is activated.

Parameters

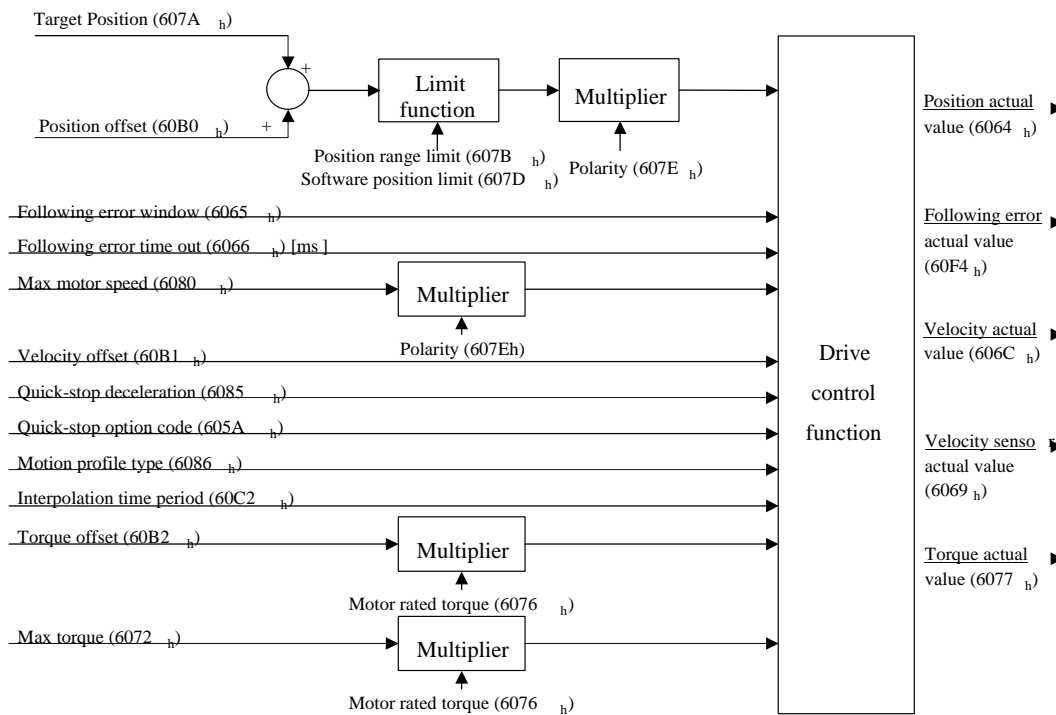
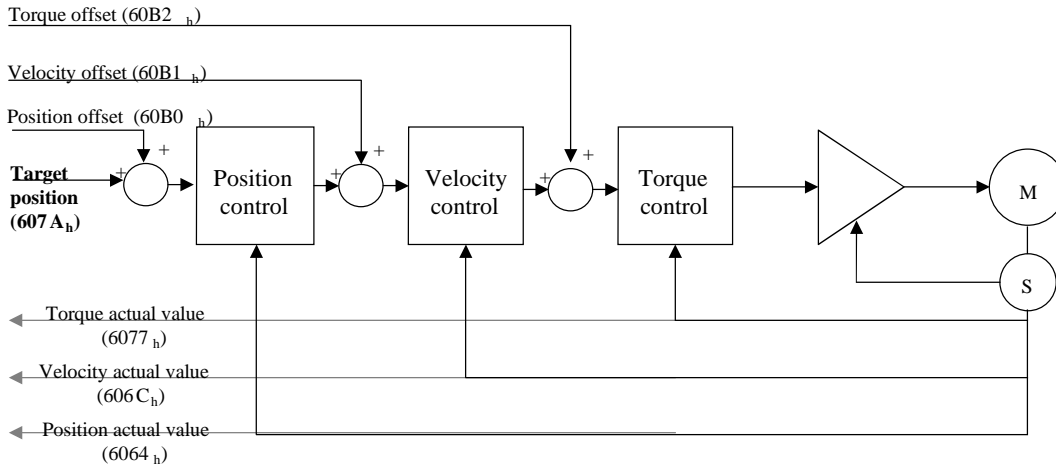
Buffer organization according method:

Interpolation method	0x60C2.01 Interpolation time period	0x60C4.05 Size of Data Record (Buffer Data Set point)	0x60C4.01 Maximum Buffer size
Linear	0	3 x 32bits: <ul style="list-style-type: none"> • Position • Abs/Rel • Period 	84 (Still 2x 32bits not used)
	<>0	2 x 32bits: <ul style="list-style-type: none"> • Position • Abs/Rel 	127
Spline	0	4 x 32bits: <ul style="list-style-type: none"> • Position • Abs/Rel • Period • End Speed 	64 (Still 2x 32bits not used)
	<>0	3 x 32bits: <ul style="list-style-type: none"> • Position • Abs/Rel • End Speed 	84 (Still 2x 32bits not used)

III.2.7 Cyclic synchronous position (csp mode)

III.2.7.1 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.



III.2.7.2 Functional description

Control Word

In this mode, the bits of control word 0x6040 do not have a special function.

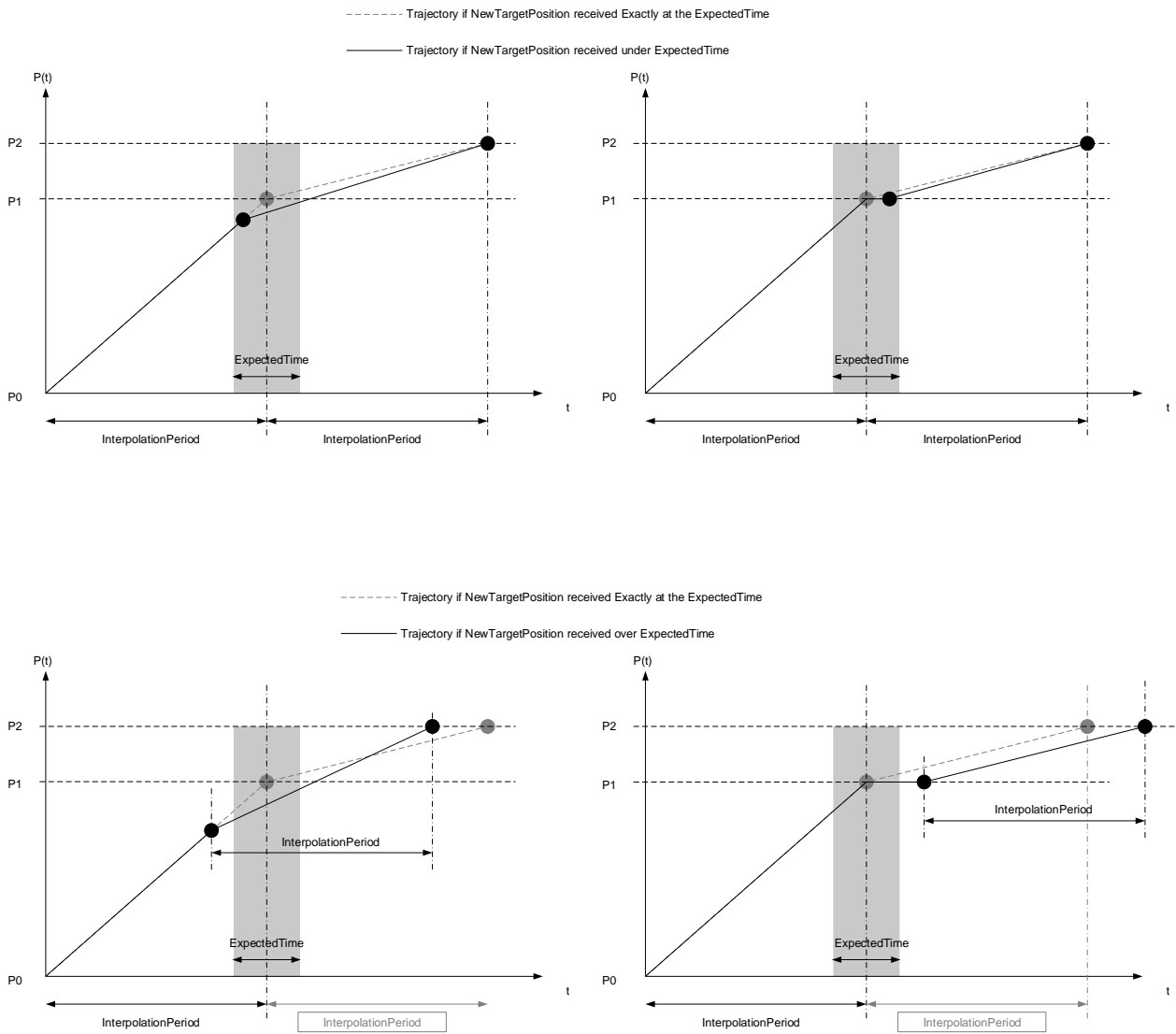
Status Word

15	14	13	12	11	10	9	0
See 0x6041 definition		Following error	Target position ignored	See 0x6041 definition	reserved		See 0x6041 definition

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

Interpolation

In this mode, a new target position must be received every interpolation time period (0x60C2). Between this time, the motor will move according a linear ramp from the current position to the target position.

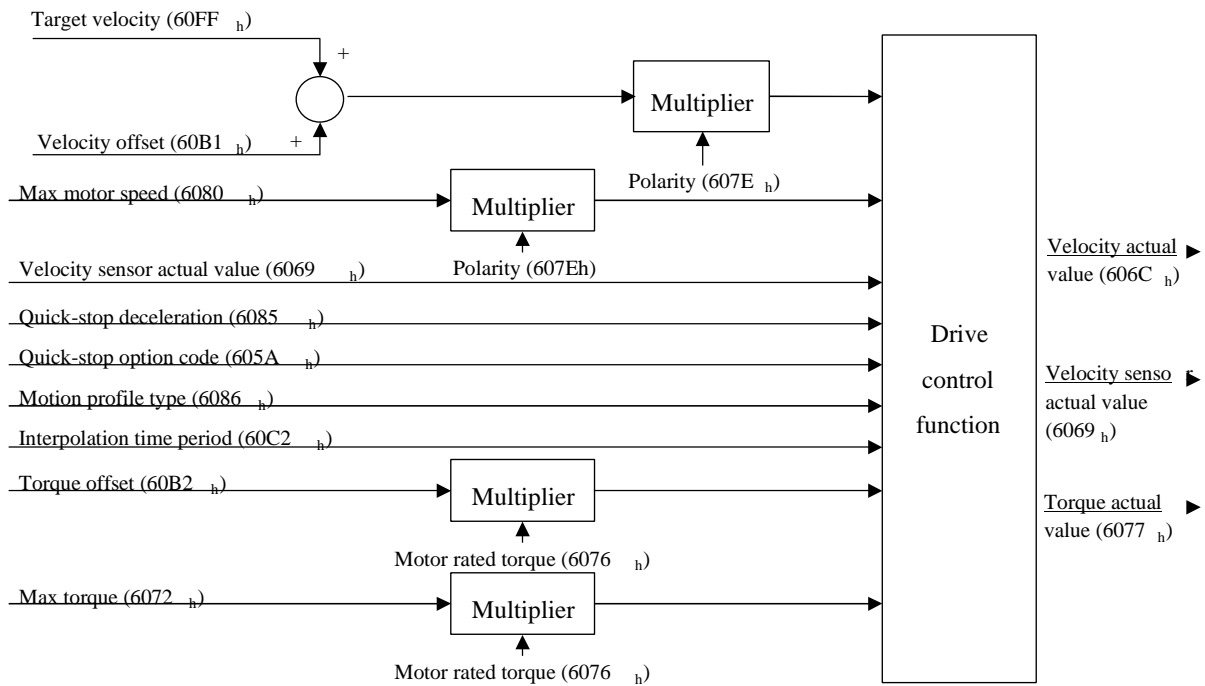
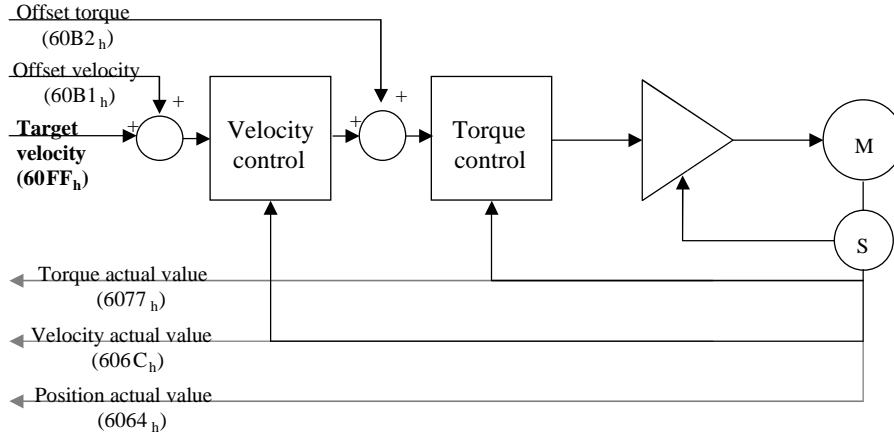


Expected time set at $\pm 1-25\%$ of Interpolationperiod

III.2.8 Cyclic synchronous velocity (csv mode)

III.2.8.1 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.



III.2.8.2 Functional description

Control Word

In this mode, the bits of control word 0x6040 do not have a special function.

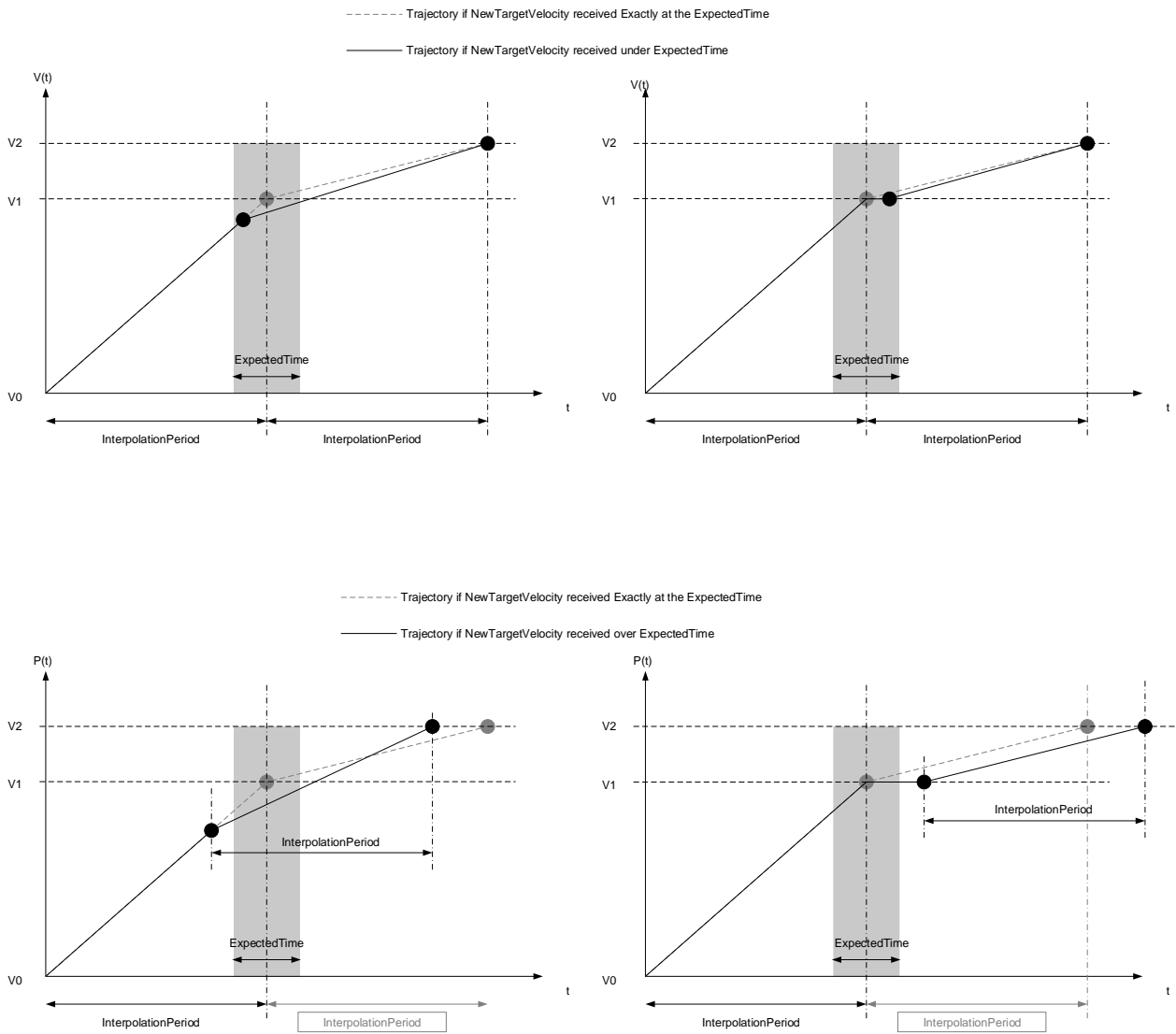
Status Word

15	14	13	12	11	10	9	0
See 0x6041 definition	reserved		Target velocity ignored	See 0x6041 definition	reserved		See 0x6041 definition
MSB						LSB	

Bit	Value	Definition
10	0	Reserved
	1	Reserved
12	0	Target Velocity ignored
	1	Target velocity shall be used as input to velocity control loop
13	0	Reserved
	1	Reserved

Interpolation

In this mode, a new target velocity must be received every interpolation time period (0x60C2). Between this time, the motor will move according a linear ramp from the current velocity to the target velocity.

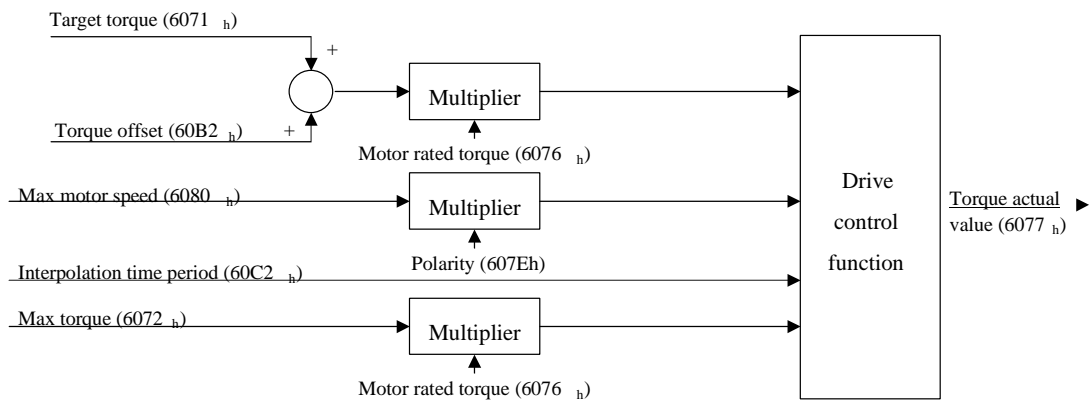
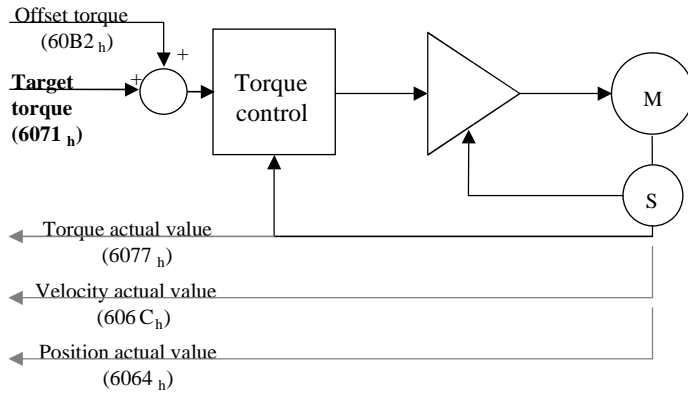


Expected time set at $\pm 1-25\%$ of Interpolation period

III.2.9 Cyclic synchronous torque (cst mode)

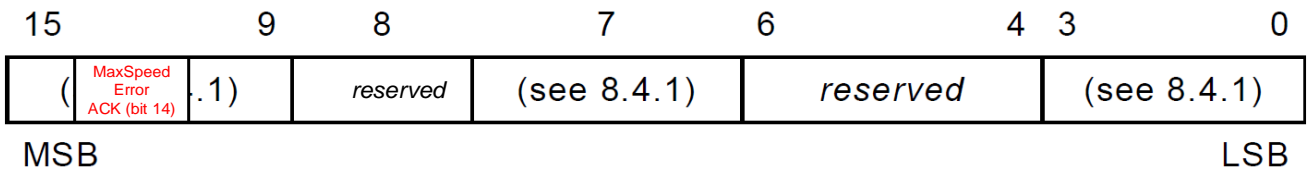
III.2.9.1 General information

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 torque to the drive device, which performs torque control.



III.2.9.2 Functional description

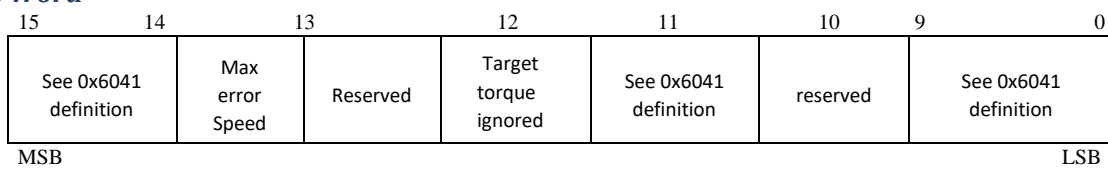
Control Word



Controlword for profil cyclic synchronous torque mode

- Bit 14: Allow to acknowledge Max Speed Error. (Must have falling edge when Max Speed Error bit is)

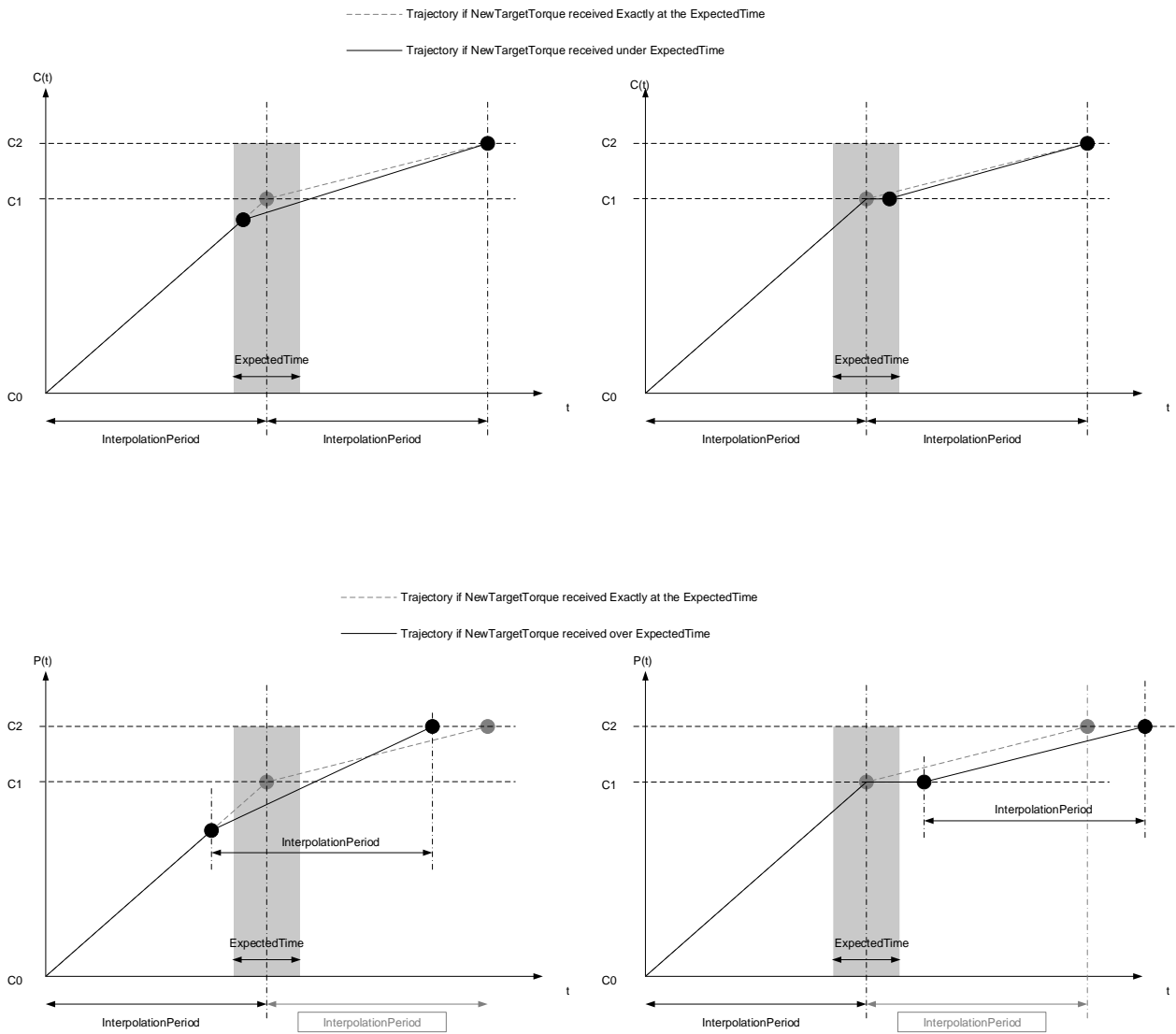
Status Word



Bit	Value	Definition
10	0	Reserved
	1	Reserved
12	0	Target torque ignored
	1	Target torque shall be used as input to torque control loop
13	0	Reserved
	1	Reserved
14	0	No error
	1	Maximum velocity was reach. Axis is in error state

Interpolation

In this mode, a new target torque must be received every interpolation time period (0x60C2).
 Between this time, the motor will move according a linear ramp from the current torque to the target torque.



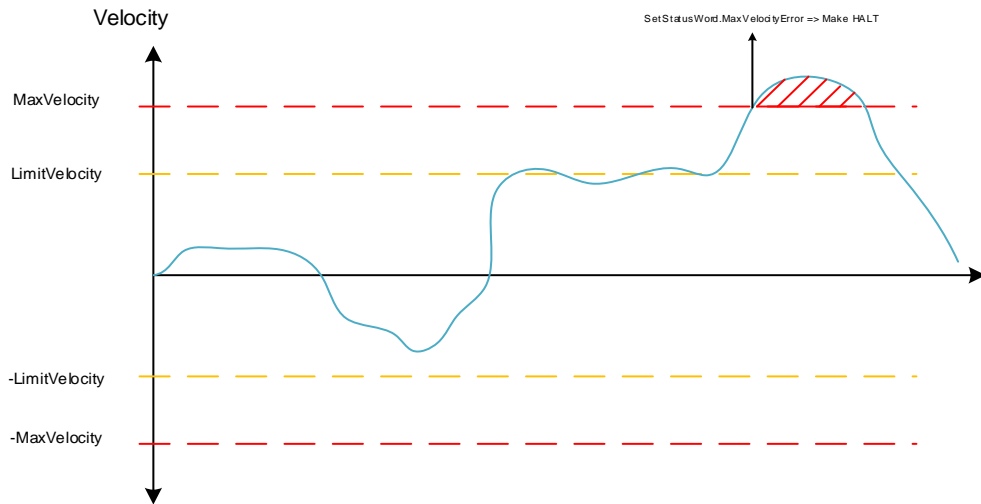
Expected time set at +/-25% of Interpolationperiod

Limit / Maximum

Drive can limit the motor velocity and generate an error if a defined maximum is reached
Refer to TorqueControl 0x2000 object.

- If TorqueControl.LimitVelocity= 0 then control is done in torque mode (Normal mode)
- If TorqueControlLimitVelocity!= 0 then control is done in velocity with limit torque defined as Maximal torque on Velocity loop control.

MaxVelocityError Must be clear to Exit Halt

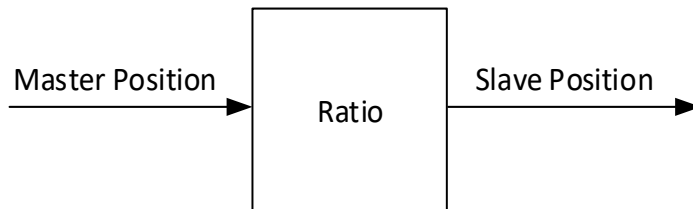


III.2.1 Gear Box (gb mode)

III.2.1.1 *General information*

With this mode, the axis is driven according a master position (Auxiliary feedback). User configure the ratio between master and slave and if the gearbox is reversible.
An acceleration phase can be configured. (“Clutch” effect).

This mode can be configured to be set automatically on power on. (Autonomous mode, without communication way)



III.2.2 Asynchronous motor

III.2.2.1 Operation

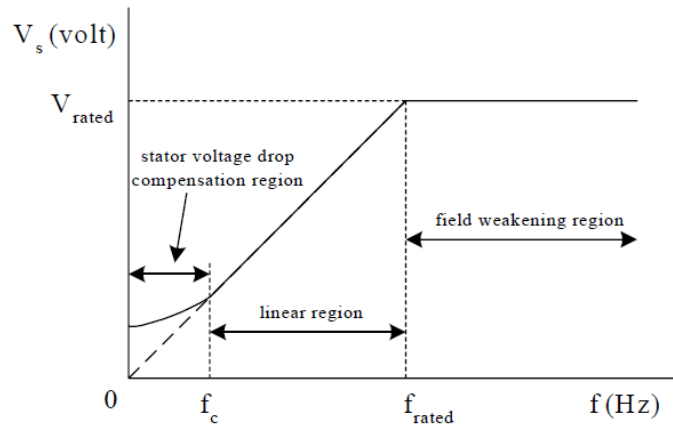
An asynchronous motor can be controlled in two ways:

- Scalar (called V/F)
- Vector

SMD only use the scalar mode

III.2.2.2 *Scalaire mode*

This is to control the motor in frequency (50Hz = nominal speed of the motor, 25Hz = half of the nominal speed), but also to vary the voltage so as to keep the V / F ratio constant. In this way, the flow in the motor is constant. The motor current (= torque) is directly proportional to the flux. So, the torque remains constant over the entire speed range and therefore even at low or zero speed. This lead to heating in the engine.



III.2.2.3 SMD using

III.2.2.4 Parameter setting

The SMD has the following parameters in order to be able to operate any asynchronous motor:

Asynchronous operating parameters 0x2709

- Command mode:
 - Discrete input (E1, E2): On/Off + Direction
 - Discrete input (E1, E2): Forward + Reverse
 - Stop
 - ON Run Forward (At the start, if in this value, force to "Stop")
 - ON Reverse (At the start, if in this value, force to "Stop")
- Stop mode:
 - Deceleration ramp
 - Freewheel
 - E3 (0 = Ramp, 1 = Freewheel)
- Setpoint source {when E4, E5, E6 = 0, 0, 0}
 - Analog input 0
 - ...
 - Analogue input n
 - Communication bus in 0.1% (TargetVelocity object 0x60FF)
 - Communication bus in 0.1Hz (TargetVelocity object 0x60FF)

Note : (0V, 0% = Fmin, 10V, 100% = FMax)

- Pre-selection speed table {when E4, E5, E6 <> 0, 0, 0}
 - Preset speed 1 [10.0Hz... 400.0Hz]
 - ...
 - Preset speed 7 [10.0Hz ... 400.0Hz]
- Acceleration time (time to go from 0 to VNominal). Unit in 0.1s
- Deceleration time (time to go from VNominal to 0). Unit in 0.1s

Asynchronous motor parameters 0x2113

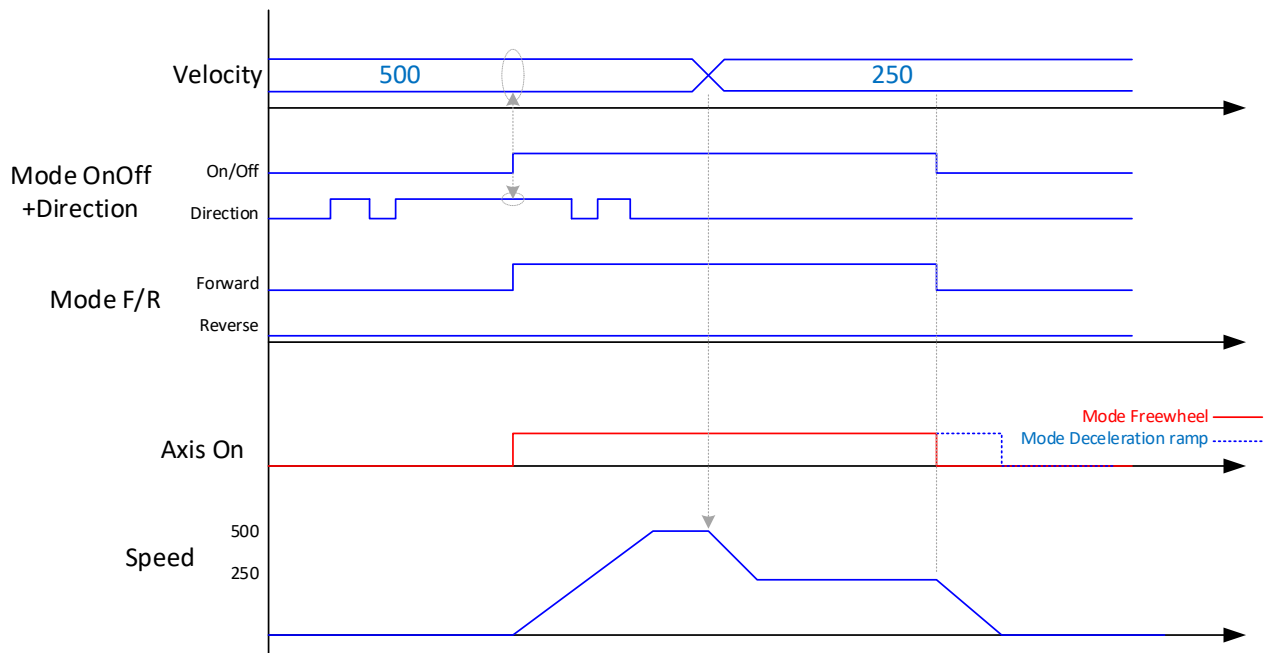
- Nominal current (Same as "Rated current Object 0x6075)
- Nominal Speed (Same as MotorParameter 0x2112.9)
- Nominal Frequency [10.0Hz..400.0Hz]
- Minimum Frequency [0.0Hz..FNom [
- Maximum Frequency [FNom..400.0Hz]
- Nominal Voltage [100.0V..480.0V]

Analog Input n Parameters 0x2403

- Offset in 1st (integer in steps of 0.001V: {-10000 .. + 10000} = {-10,000V .. + 10,000V}
- Gain in 2nd (integer in steps of 0.1: {1 ... 10000} = {0.01 .. 100.00})
- Tau filtering (integer in ms)

III.2.2.5 Operation

To adapt to the DS402 standard, a new operating mode is created: Velocity Asynchronous Mode.



- If the speed reference source changes during a movement, the new speed will be taken into account
- The direction of rotation is only taken into account when torque On.
- The speed instructions are not limited to writing (preselection table, etc.). On the other hand, when it is executed, the actual instruction applied will be limited to {FMin...FMax}
- No control of the asynchronous motor via DriveStudio is possible. Will only be used for setting and viewing the speed in progress.
- If fault, it must be acknowledged as in VALIDATION mode: When "Axis Off" is requested. (Via input E1 / E2 or COM bus depending on command mode)

IV. Object dictionary description

IV.1 Communication profile specific objects

IV.1.1 Object 1000_h: Device type

This object shall provide information about the device type. The object describes the type of the logical device and its functionality.

VALUE DEFINITION

Fixed value: 0x0002 0192.

This value indicates the DS402 (402 = 0x192) and additional information is 0x0002 (In case of ECAT device, this indicate EtherCAT servo drive no safety option.

(Defined in ETG.6010 §15)

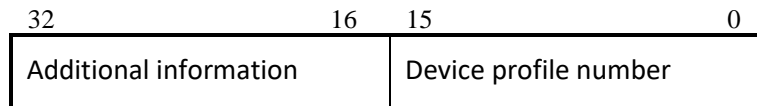


Figure: Structure of the device type parameter

OBJECT DESCRIPTION

Index	1000 _h
Name	Device type
Object code	VAR
Data type	UNSIGNED32
Category	Mandatory

ENTRY DESCRIPTION

Sub-index	00 _h
Access	ro
PDO mapping	No
Value range	See value definition
Default value	Profile- or manufacturer-specific

IV.1.2 Object 1001_h: Error register

This object shall provide error information. The CANopen device maps internal errors into this object. It is a part of an emergency object.

VALUE DEFINITION

Table: Structure of the error register

Bit	M/O	Meaning
0	M	Generic error
1	O	Current
2	O	Voltage
3	O	Temperature
4	O	Communication error (overrun, error state)
5	O	Device profile specific
6	O	reserved (always 0 _b)
7	O	manufacturer-specific

If a specific error occurs the corresponding bit shall be set to 1_b.

OBJECT DESCRIPTION

Index	1001 _h
Name	Error register
Object code	VAR
Data type	UNSIGNED8
Category	Mandatory

ENTRY DESCRIPTION

Sub-index	00 _h
Access	ro
PDO mapping	Optional
Value range	See value definition
Default value	No

IV.1.3 Object 1003_h: Pre-defined error field

This object shall provide the errors that occurred on the CANopen device and were signalled via the emergency object. In doing so it provides an error history.

VALUE DEFINITION

- The object entry at sub-index 00_h shall contain the number of actual errors that are recorded in the array starting at sub-index 01_h.
NOTE: If no error is present the value of sub-index 00_h is 00_h and a read access to sub-index 01_h is responded with an SDO abort message (abort code: 0800 0024_h or 0800 0000_h).
- Every new error is stored at sub-index 01_h; older errors is moved to the next higher sub-index.
- Writing 00_h to sub-index 00_h delete the entire error history (empties the array). Other values than 00_h are not allowed and lead to an abort message (error code: 0609 0030_h).

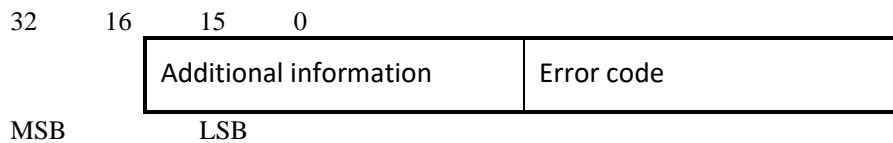


Figure: Structure of the pre-defined error field

OBJECT DESCRIPTION

Index	1003 _h
Name	Pre-defined error field
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Description	Number of errors
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	00 _h to FE _h
Default value	00 _h

Sub-index	01 _h
Description	Standard error field
Entry category	Mandatory
Access	ro

PDO mapping	No
Value range	UNSIGNED32
Default value	No

Sub-index	02 _h to FE _h
Description	Standard error field
Entry category	Optional
Access	ro
PDO mapping	No
Value range	UNSIGNED32
Default value	No

IV.1.4 Object 1005_h: COB-ID SYNC message

This object shall indicate the configured COB-ID of the synchronization object (SYNC). Further, it defines whether the CANopen device generates the SYNC.

VALUE DEFINITION

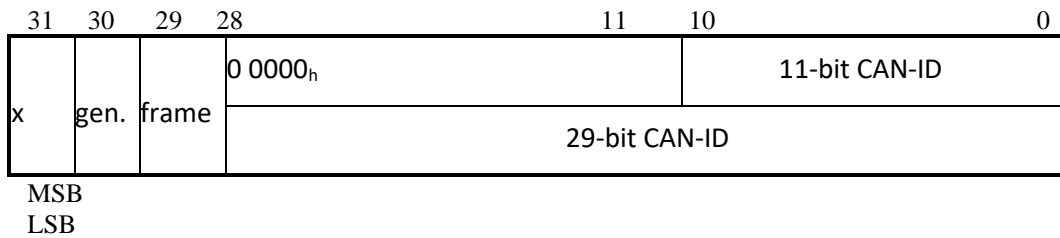


Figure: Structure of SYNC COB-ID
 Table: Description of SYNC COB-ID

Bit(s)	Value	Description
x	x	do not care
gen.	0 _b	CANopen device does not generate SYNC message
	1 _b	CANopen device generates SYNC message
frame	0 _b	11-bit CAN-ID valid (CAN base frame)
	1 _b	29-bit CAN-ID valid (CAN extended frame)
29-bit CAN-ID	x	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	x	11-bit CAN-ID of the CAN base frame

Bits 29 (frame) and bit 30 (gen.) may be static (not changeable). The first transmission of SYNC object starts within 1 sync cycle after setting bit 30 to 1_b. By setting bit 30 to 1_b while the synchronous counter overflow value is greater than 0 the first SYNC message shall start with the counter reset to 1. It is not allowed to change bits 0 to 29, while the object exists (bit 30 = 1_b).

OBJECT DESCRIPTION

Index	1005 _h
Name	COB-ID SYNC
Object code	VAR
Data type	UNSIGNED32
Category	Conditional; Mandatory, if PDO communication on a synchronous base is supported

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw-NV
PDO mapping	No
Value range	See value definition
Default value	0000 0080 _h or 8000 0080 _h

IV.1.5 Object 1006_h: Communication cycle period

This object shall provide the communication cycle period. This period defines the SYNC interval.

VALUE DEFINITION

The value is given in multiple of μs . If the value is set to 0000 0000_h the transmission of SYNC messages is disabled. By changing the value from 0000 0000_h and the synchronous counter overflow value is greater than 0 the first SYNC message start with the counter value reset to 1.

The transmission of SYNC messages starts within one communication cycle period as given by the value after it is set to the new value.

OBJECT DESCRIPTION

Index	1006 _h
Name	Communication cycle period
Object code	VAR
Data type	UNSIGNED32
Category	Conditional; Mandatory for SYNC producers

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw -NV
PDO mapping	No
Value range	UNSIGNED32
Default value	0000 0000 _h

IV.1.6 Object 1007_h: Synchronous window length

This object indicates the configured length of the time window for synchronous PDOs. If the synchronous window length expires all synchronous TPDOs is discarded and an EMCY message is transmitted; all synchronous RPDOs is discarded until the next SYNC message is received. Synchronous RPDO processing is resumed with the next SYNC message.

VALUE DEFINITION

The value is given in multiple of μs . If the value is set to 0000 0000_h the synchronous window shall be disabled.

OBJECT DESCRIPTION

Index	1007 _h
Name	Synchronous window length
Object code	VAR
Data type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw -NV
PDO mapping	No
Value range	UNSIGNED32
Default value	0000 0000 _h

IV.1.7 Object 1008_h: Manufacturer device name

This object provides the name of the device as given by the manufacturer.

OBJECT DESCRIPTION

Index	1008 _h
Name	Manufacturer device name
Object code	VAR
Data type	VISIBLE_STRING
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Access	const
PDO mapping	No
Value range	VISIBLE_STRING
Default value	Manufacturer-specific

IV.1.8 Object 1009_h: Manufacturer hardware version

This object provides the manufacturer hardware version description.

OBJECT DESCRIPTION

Index	1009 _h
Name	Manufacturer hardware version
Object code	VAR
Data type	VISIBLE_STRING
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Access	const
PDO mapping	No
Value range	VISIBLE_STRING
Default value	Manufacturer-specific

IV.1.9 Object 100A_h: Manufacturer software version

This object provides the manufacturer software version description.

OBJECT DESCRIPTION

Index	100A _h
Name	Manufacturer software version
Object code	VAR
Data type	VISIBLE_STRING
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Access	const
PDO mapping	No
Value range	VISIBLE_STRING
Default value	Manufacturer-specific

IV.1.10 Object 100C_h: Guard time

The objects at index 100C_h and 100D_h indicate the configured guard time respectively the life time factor. The life time factor multiplied with the guard time gives the life time for the life guarding protocol.

VALUE DEFINITION

The value is given in multiple of ms. The value of 0000h disable the life guarding.

OBJECT DESCRIPTION

Index	100C _h
Name	Guard time
Object code	VAR
Data type	UNSIGNED16
Category	Conditional; Mandatory, if node guarding is supported

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw-NV;
PDO mapping	No
Value range	UNSIGNED16
Default value	0000 _h

IV.1.11 Object 100D_h: Life time factor

The life time factor multiplied with the guard time gives the life time for the life guarding protocol.

VALUE DEFINITION

The value of 00_h disable the life guarding.

OBJECT DESCRIPTION

Index	100D _h
Name	Life time factor
Object code	VAR
Data type	UNSIGNED8
Category	Conditional; Mandatory, if node guarding is supported

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw-NV;
PDO mapping	No
Value range	UNSIGNED8
Default value	00 _h

IV.1.12 Object 1010_h: Store parameters

This object controls the saving of parameters in non-volatile memory.

VALUE DEFINITION

By read access the CANopen device shall provide information about its saving capabilities. Several parameter groups are distinguished:

- Sub-index 00_h contains the highest sub-index that is supported.
- Sub-index 01_h refers to all parameters that may be stored on the CANopen device:

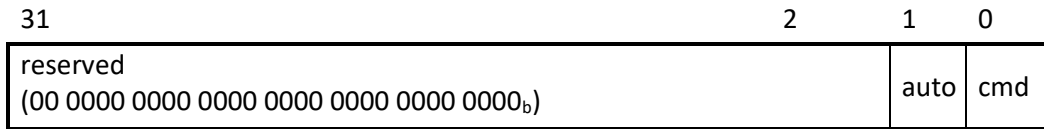


Figure: Storage read access structure

Table: Structure of read access

Bit	Value	Description
auto	0 _b	CANopen device does not save parameters autonomously
	1 _b	CANopen device saves parameters autonomously
cmd	0 _b	CANopen device does not save parameters on command
	1 _b	CANopen device saves parameters on command

Autonomous saving means that a CANopen device stores the storable parameters in a non-volatile manner without user request.

OBJECT DESCRIPTION

Index	1010 _h
Name	store parameters
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Description	highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	01 _h to 7F _h
Default value	profile- or manufacturer-specific

Sub-index	01 _h
Description	save all parameters
Entry category	Mandatory
Access	ro, autonomous storing
PDO mapping	No
Value range	see value definition
Default value	0x02

IV.1.13 Object 1011_h: Restore default parameters

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

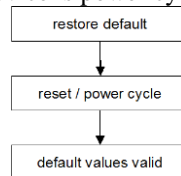
VALUE DEFINITION

- By read access the CANopen device shall provide information about its capabilities to restore these values. Several parameter groups are distinguished:
- Sub-index 00_h contains the highest sub-index that is supported.
- Sub-index 01_h refers to all parameters that may be restored. (Only if allowed by object 2806_h)
- Sub-index 04_h refers to all parameters that may be restored.

In order to avoid the restoring of default parameters by mistake, restoring shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is "load":

d	a	o	l
64 _h	61 _h	6F _h	6C _h

On reception of the correct signature in the appropriate sub-index the CANopen device restore the default parameters and then it confirms the SDO transmission (SDO download initiate response). If the restoring failed, the CANopen device respond with the SDO abort transfer service (abort code: 0606 0000_h). If a wrong signature is written, the CANopen device refuse to restore the defaults and respond with the SDO abort transfer service (abort code: 0800 002x_h). The default value is set valid after the CANopen device is power cycled.



On read access to the appropriate sub-index the CANopen device provide information about its default parameter restoring capability with the following format:

31	1	0
reserved (000 0000 0000 0000 0000 0000 0000 0000 _b)	cmd	

Bit	Value	Description
cmd	0 _b	CANopen device does not restore default parameters
	1 _b	CANopen device restores parameters

OBJECT DESCRIPTION

Index	1011 _h
Name	restore default parameters
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Description	highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	01 _h to 7F _h
Default value	profile- or manufacturer-specific

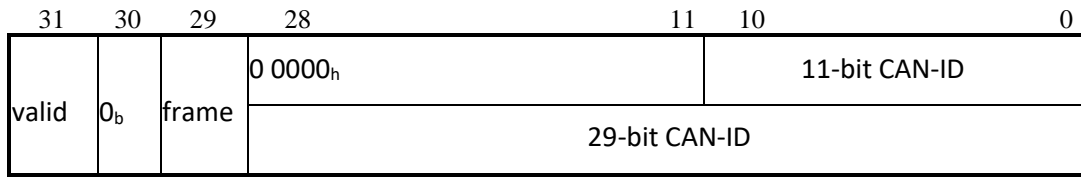
Sub-index	01 _h
Description	restore all default parameters if allowed by object 0x2806
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	see value definition
Default value	0x01

Sub-index	04 _h
Description	restore all default parameters
Entry category	Mandatory
Access	rw
PDO mapping	No
Value range	see value definition
Default value	0x01

IV.1.14 Object 1014_h: COB-ID EMCY

This object shall indicate the configured COB-ID for the EMCY write service.

VALUE DEFINITION



Bit(s)	Value	Description
valid	0 _b	EMCY exists / is valid
	1 _b	EMCY does not exist / is not valid
30	0 _b	reserved (always 0 _b)
frame	0 _b	11-bit CAN-ID valid (CAN base frame)
	1 _b	29-bit CAN-ID valid (CAN extended frame)
29-bit CAN-ID	x	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	x	11-bit CAN-ID of the CAN base frame

The bits 0 to 29 shall not be changed, while the object exists and is valid (bit 31 = 0_b).

OBJECT DESCRIPTION

Index	1014 _h
Name	COB-ID emergency message
Object code	VAR
Data type	UNSIGNED32
Category	Conditional; Mandatory, if Emergency is supported

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw; const, if COB-ID is not changeable
PDO mapping	No
Value range	UNSIGNED32

Default value	CAN-ID: 80 _h + Node-ID frame: 0 _b valid: profile- or manufacturer-specific
---------------	--

IV.1.15 Object 1016_h: Consumer heartbeat time

The consumer heartbeat time object indicates the expected heartbeat cycle times. Monitoring of the heartbeat producer start after the reception of the first heartbeat.

NOTE: The consumer heartbeat time should be higher than the corresponding producer heartbeat time.

NOTE: Before the reception of the first heartbeat the status of the heartbeat producer is unknown.

VALUE DEFINITION

31	24	23	16	15	0
reserved (00 _h)		Node-ID		Heartbeat time	

If the heartbeat time is 0 or the node-ID is 0 or greater than 127 the corresponding object entry shall be not used. The heartbeat time is be given in multiples of 1ms.

An attempt to configure several heartbeat times unequal 0 for the same node-ID the CANopen device is responded with the SDO abort transfer service (abort code: 0604 0043_h).

OBJECT DESCRIPTION

Index	1016 _h
Name	Consumer heartbeat time
Object code	ARRAY
Data type	UNSIGNED32
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	01 _h to 7F _h
Default value	profile- or manufacturer-specific

Sub-index	01 _h
Description	Consumer heartbeat time
Entry category	Mandatory
Access	rw -NV
PDO mapping	No

Value range	UNSIGNED32 (Figure 62)
Default value	0000 0000 _h

Sub-index	02 _h to 7F _h
Description	Consumer heartbeat time
Entry category	Optional
Access	rw
PDO mapping	No
Value range	UNSIGNED32 (Figure 62)
Default value	0000 0000 _h

IV.1.16 Object 1017_h: Producer heartbeat time

The producer heartbeat time indicate the configured cycle time of the heartbeat.

VALUE DEFINITION

The value is given in multiples of 1 ms. The value 0 shall disable the producer heartbeat.

OBJECT DESCRIPTION

Index	1017 _h
Name	Producer heartbeat time
Object code	VAR
Data type	UNSIGNED16
Category	Conditional; Mandatory, if guarding not supported

ENTRY DESCRIPTION

Sub-index	00 _h
Access	rw -NV
PDO mapping	No
Value range	UNSIGNED16
Default value	0 or profile-specific

IV.1.17 Object 1019_h: Synchronous counter overflow value

This object indicates the configured highest value the synchronous counter supports. This object is implemented by the producer and the consumer, if the synchronous counter is supported by the CANopen device. If the value is greater than 1, the SYNC message has a data length of 1 byte. The SYNC consumer shall ignore the value itself. An EMCY message (error code: 8240_h – unexpected SYNC data length) may be transmitted by a SYNC consumer in the case the configured data length of the SYNC message does not meet the data length of a received SYNC message.

VALUE DEFINITION

Value	Description
0	The SYNC message shall be transmitted as a CAN message of data length 0.
1	reserved
2 to 240	The SYNC message shall be transmitted as a CAN message of data length 1. The first data byte contains the counter.
241 to 255	reserved

The value used shall be the least common multiple of all the TPDO transmission types ($1 < n \leq 240$) used. This ensures that periodic SYNC events always happen in the SYNC cycles with the same counter value.

A change of the value shall be responded with a SDO abort (abort code: 0800 0022_h or 0800 0000_h) in case the sync cycle period is unequal to 0.

OBJECT DESCRIPTION

Index	1019 _h
Name	Synchronous counter overflow value
Object code	VAR
Data type	UNSIGNED8
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Access	Rw-NV;
PDO mapping	No
Value range	UNSIGNED8
Default value	0 or profile-specific

IV.1.18 Object 1029_h: Error behaviour object

If a serious CANopen device failure is detected in NMT state Operational, the CANopen device shall enter by default autonomously the NMT state Pre-operational. The CANopen device is configurable to enter alternatively the NMT state Stopped or remain in the current NMT state. CANopen device failures shall include the following communication errors:

- Bus-off conditions of the CAN interface
- Life guarding event with the state 'occurred' and the reason 'time out'
- Heartbeat event with state 'occurred' and the reason 'time out'

Severe CANopen device errors also may be caused by CANopen device internal failures.

VALUE DEFINITION

Table: Error class values

Value	Description
00 _h	Change to NMT state Pre-operational (only if currently in NMT state Operational)
01 _h	No change of the NMT state
02 _h	Change to NMT state Stopped
03 _h	reserved
.....
7F _h	reserved
80 _h	Manufacturer-specific
.....
FF _h	Manufacturer-specific

OBJECT DESCRIPTION

Index	1029 _h
Name	Error behaviour
Object code	ARRAY
Data type	UNSIGNED8
Category	Optional

ENTRY DESCRIPTION

Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No

Value range	01 _h to FE _h
Default value	profile- or manufacturer-specific

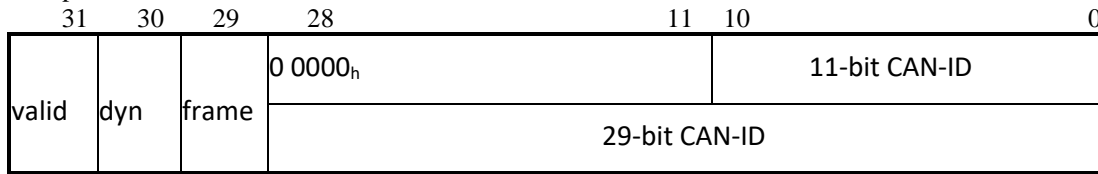
Sub-index	01 _h
Description	Communication error
Entry category	Mandatory
Access	Rw-NV
PDO mapping	No
Value range	UNSIGNED8
Default value	00 _h

IV.1.19 Object 1200_h: SDO server parameter

In order to describe the SDOs used on a CANopen device the data type SDO Parameter is introduced. The data type has the index 22_h in the object dictionary.

VALUE DEFINITION

The number of supported object entries in the SDO object record is specified at sub-index 00_h. The values at sub-index 01_h and sub-index 02_h specify the COB-ID for this SDO. Sub-index 03_h is the node-ID of the SDO client associated to this CANopen device.



Bit(s)	Value	Description
valid	0 _b	SDO exists / is valid
	1 _b	SDO does not exist / is not valid
dyn	0 _b	Value is assigned statically
	1 _b	Value is assigned dynamically
frame	0 _b	11-bit CAN-ID valid (CAN base frame)
	1 _b	29-bit CAN-ID valid (CAN extended frame)
29-bit CAN-ID	x	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	x	11-bit CAN-ID of the CAN base frame

An SDO exists only if at both sub-index 01_h and sub-index 02_h the bit valid (bit 31) is set to 0_b. CANopen devices supporting the CAN base frame type only, an attempt to set bit 29 (frame) to 1_b is responded with the SDO abort transfer service (abort code: 0609 0030_h). It is not allowed to change bits 0 to 29 while the object exists and is valid (bit 31 = 0_b).

OBJECT DESCRIPTION

Index	1200 _h
Name	SDO server parameter
Object code	RECORD
Data type	SDO parameter record
Category	Conditional Index 1200 _h : Optional

ENTRY DESCRIPTION

Sub-index	00 _h
-----------	-----------------

Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	Index 1200 _h : 02 _h
Default value	profile or manufacturer-specific

Sub-index	01 _h
Description	COB-ID client -> server (rx)
Entry category	Mandatory
Access	Index 1200 _h : const
PDO mapping	Optional
Value range	see value definition
Default value	Index 1200 _h : CAN-ID: 600 _h + Node-ID frame: 0 _b dyn: 0 _b valid: 0 _b

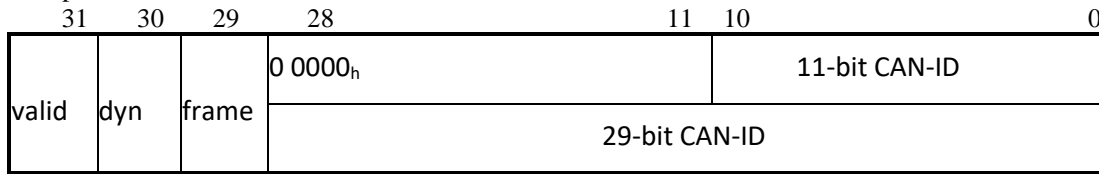
Sub-index	02 _h
Description	COB-ID server -> client (tx)
Entry category	Mandatory
Access	Index 1200 _h : ro
OPDO mapping	Optional
Value range	see value definition
Default value	Index 1200 _h : CAN-ID: 580 _h + Node-ID frame: 0 _b dyn: 0 _b valid: 0 _b

IV.1.20 Object 1280_h: SDO client parameter

These objects contain the parameters for the SDOs for which the CANopen device is the SDO client.

VALUE DEFINITION

The number of supported object entries in the SDO object record is specified at sub-index 00_h. The values at sub-index 01_h and sub-index 02_h specify the COB-ID for this SDO. Sub-index 03_h is the node-ID of the SDO server associated to this CANopen device.



Bit(s)	Value	Description
valid	0 _b	SDO exists / is valid
	1 _b	SDO does not exist / is not valid
dyn	0 _b	Value is assigned statically
	1 _b	Value is assigned dynamically
frame	0 _b	11-bit CAN-ID valid (CAN base frame)
	1 _b	29-bit CAN-ID valid (CAN extended frame)
29-bit CAN-ID	x	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	x	11-bit CAN-ID of the CAN base frame

An SDO exists only if at both sub-index 01_h and sub-index 02_h the bit valid (bit 31) is set to 0_b. CANopen devices supporting the CAN base frame type only, an attempt to set bit 29 (frame) to 1_b is responded with the SDO abort transfer service (abort code: 0609 0030_h). It is not allowed to change bits 0 to 29 while the object exists and is valid (bit 31 = 0_b). CANopen devices supporting the enabling (bit 31 = 0_b) and disabling (bit 31 = 1_b) of the SDO client only shall respond with the SDO abort transfer service (abort code: 0609 0030_h or 0800 000_h) on an attempt to change the values from bit 0 to bit 30.

OBJECT DESCRIPTION

Index	1280 _h
Name	SDO client parameter
Object code	RECORD
Data type	SDO Parameter
Category	Conditional; Mandatory for each supported SDO client

ENTRY DESCRIPTION

Sub-index	00 _h
Description	Highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	03 _h
Default value	03 _h

Sub-index	01 _h
Description	COB-ID client -> server (tx)
Entry category	Mandatory
Access	const
PDO mapping	Optional
Value range	see value definition
Default value	CAN-ID: manufacturer-specific (see clause 7.3.5) frame: manufacturer-specific dyn: 0 _b valid: 1 _b or defined by application profile

Sub-index	02 _h
Description	COB-ID server -> client (rx)
Entry category	Mandatory
Access	const
PDO mapping	Optional
Value range	see value definition
Default value	CAN-ID: manufacturer-specific (see clause 7.3.5) frame: manufacturer-specific dyn: 0 _b valid: 1 _b or defined by application profile

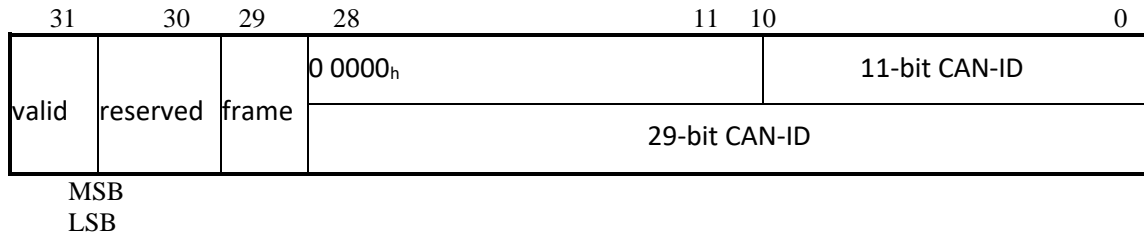
Sub-index	03 _h
Description	Node-ID of the SDO server
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	01 _h to 7F _h
Default value	manufacturer-specific

IV.1.21 Object 1400_h to 1407_h: RPDO communication parameter

This object contains the communication parameters for the PDOs the CANopen device is able to receive.

VALUE DEFINITION

Sub-index 00_h contains the number of valid object entries within the record. Its value is at least 02_h. If inhibit time supported the value is 03_h and if event timer is supported the value is 05_h. Sub-index 01_h contains the COB-ID of the RPDO.



Bit(s)	Value	Description
valid	0 _b	PDO exists / is valid
	1 _b	PDO does not exist / is not valid
reserved	x	do not care
frame	0 _b	11-bit CAN-ID valid (CAN base frame)
	1 _b	29-bit CAN-ID valid (CAN extended frame)
29-bit CAN-ID	x	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	x	11-bit CAN-ID of the CAN base frame

The bit valid (bit 31) allows selecting which RPDOs are used in the NMT state Operational. There may be PDOs fully configured (e.g., by default) but not used, and therefore set to "not valid" (deleted). CANopen devices supporting the CAN base frame type only an attempt to set bit 29 (frame) to 1_b is responded with the SDO abort transfer service (abort code: 0609 0030_h). It is not allowed to change bit 0 to 29 while the PDO exists and is valid (bit 31 = 0_b). CANopen devices supporting the enabling (bit 31 = 0_b) and disabling (bit 31 = 1_b) of an RPDO only shall respond with the SDO abort transfer service (abort code: 0609 0030_h or 0800 000_h) on an attempt to change the values from bit 0 to bit 30.

If the CANopen device has implemented one or more device profiles the generic pre-defined connection set shall apply.

Index	Default value
1400 _h	CAN-ID: 200 _h + Node-ID frame: 0 _b reserved: manufacturer-specific valid: profile or manufacturer-specific
1401 _h	CAN-ID: 300 _h + Node-ID 29-bit: 0 _b reserved: manufacturer-specific valid: profile or manufacturer-specific
1402 _h	CAN-ID: 400 _h + Node-ID frame: 0 _b reserved: manufacturer-specific valid: profile- or manufacturer-specific

1403 _h	CAN-ID: 500 _h + Node-ID frame: 0 _b reserved: manufacturer-specific valid: profile- or manufacturer-specific
Index	Default value
1404 _h to 1407_h	CAN-ID: profile- or manufacturer-specific (see clause 7.3.5) frame: profile- or manufacturer-specific reserved: manufacturer-specific valid: 1 _b or defined by application profile

If the CANopen device has implemented an application profile the specific pre-defined connection set of that application profile shall apply.

Sub-index 02_h defines the reception character of the RPDO (see Table 68). An attempt to change the value of the transmission type to any not supported value shall be responded with the SDO abort transfer service (abort code: 0609 0030_h).

Value	Description
00 _h	synchronous
.....
F0 _h	synchronous
F1 _h	reserved
.....
FD _h	reserved
FE _h	event-driven (device profile and application profile specific) Receive-PDOs will be evaluated immediately after receipt
FF _h	event-driven (device profile and application profile specific) Receive-PDOs will be evaluated immediately after receipt only if inhibit time is elapsed, else R-Pdo is discarded!

- Synchronous means that the CANopen device shall actuate the received data with the reception of the next SYNC (see Figure 68).
- Event-driven means that the PDO may be received at any time. The CANopen device will actualize the data immediately.

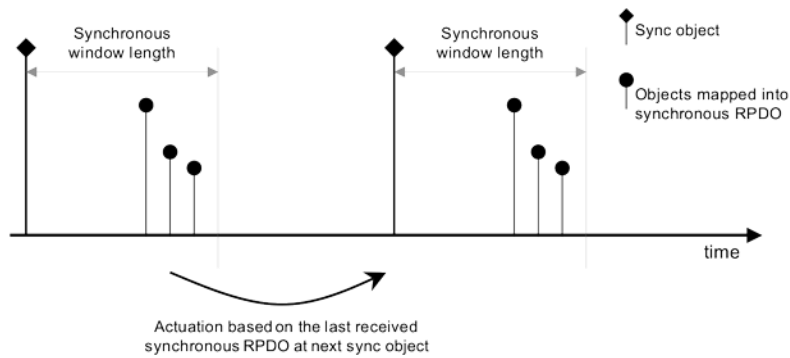


Figure: Bus synchronization and actuation

Sub-index 03_h contains the inhibit time. The value is defined as multiple of 100 μs. The value of 0 shall disable the inhibit time. It is not allowed to change the value while the PDO exists (bit 31 of sub-index 01_h is set to 0_b). The RPDO may use the time implementation specific.

Sub-index 04_h is reserved. It shall not be implemented; in this case read or write access leads to the SDO abort transfer service (abort code: 0609 0011_h).

Sub-index 05_h contains the event-timer. The value is defined as multiple of 1 ms. The value of 0 shall disable the event-timer. The RPDO may use the time for deadline monitoring. The deadline monitoring is activated within the next reception of an RPDO after configuring the event-timer. A timeout results in an indication to the local application.

Sub-index 06_h contains the SYNC start value. This is not used by RPDOs. It shall not be implemented; in this case read or write access shall lead to the SDO abort transfer service (abort code: 0609 0011_h).

OBJECT DESCRIPTION

Index	1400 _h to 1407 _h
Name	RPDO communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Conditional; Mandatory for each supported RPDO

ENTRY DESCRIPTION

Sub-index	00 _h
Description	highest sub-index supported
Entry category	Mandatory
Access	const
PDO mapping	No
Value range	02 _h to 06 _h
Default value	No

Sub-index	01 _h
-----------	-----------------

Description	COB-ID used by RPDO
Entry category	Mandatory
Access	rw; const, if COB-ID is not changeable
PDO mapping	No
Value range	see value definition
Default value	see value definition

Sub-index	02 _h
Description	transmission type
Entry category	Mandatory
Access	rw; const, if transmission type is not changeable
PDO mapping	No
Value range	see value definition
Default value	Profile- or manufacturer specific

Sub-index	03 _h
Description	inhibit time
Entry category	Optional
Access	rw; const, if inhibit time is not changeable
PDO mapping	No
Value range	see value definition
Default value	Profile- or manufacturer specific

Sub-index	04 _h
Description	compatibility entry
Entry category	Optional
Access	rw

PDO mapping	No
Value range	UNSIGNED8
Default value	Manufacturer specific

Sub-index	05 _h
Description	event-timer
Entry category	Optional
Access	rw; const, if event timer is not changeable
PDO mapping	No
Value range	see value definition
Default value	Profile- or manufacturer specific

Sub-index	06 _h
Description	SYNC start value
Entry category	Optional
Access	rw const, if SYNC start value is not changeable
PDO mapping	No
Value range	UNSIGNED8
Default value	Profile- or manufacturer specific

IV.1.22 Object 1600_h to 1607_h: RPDO mapping parameter

This object contains the mapping parameters for the PDOs the CANopen device is able to receive.

VALUE DEFINITION

Sub-index 00_h contains the number of valid object entries within the mapping record or a specific value (see Table 69), e.g., if MPDO is supported. The number of valid object entries shall be the number of the application objects that shall be received with the corresponding RPDO.

Table: RPDO mapping values

Value	Description
00 _h	Mapping disabled
01 _h	Sub-index 01 _h valid
02 _h	Sub-index 01 _h and 02 _h valid
03 _h	Sub-index from 01 _h to 03 _h valid
04 _h	Sub-index from 01 _h to 04 _h valid
.....
40 _h	Sub-index from 01 _h to 40 _h valid
41 _h	reserved
.....
FD _h	reserved
FE _h	SAM-MPDO
FF _h	DAM-MPDO

Sub-index from 01_h to 40_h contains the information of the mapped application objects. The object describes the content of the PDO by their index, sub-index and length. The length contains the length of the application object in bit. This may be used to verify the mapping.



Figure: Structure of RPDO mapping

An attempt to change the value of an object entry to any value that is not supported shall be responded with the SDO abort transfer service. The cause for a not supported value could be the mapping (index and sub-index) of a non-existing application object, a wrong length for the mapped application object, or a wrong length for the PDO at all. The index and sub-index may reference a simple data type (see Table 44) for the so-called dummy mapping. This may be used if no appropriate application object is available and to fill up the length of the RPDO to fit the length to the according TPDO. The following procedure shall be used for re-mapping, which may take place during the NMT state Pre-operational and during the NMT state Operational, if supported:

1. Destroy RPDO by setting bit *valid* to 1_b of sub-index 01_h of the according RPDO communication parameter.
2. Disable mapping by setting sub-index 00_h to 00_h.
3. Modify mapping by changing the values of the corresponding sub-indices.
4. Enable mapping by setting sub-index 00_h to the number of mapped objects.
5. Create RPDO by setting bit *valid* to 0_b of sub-index 01_h of the according RPDO communication parameter.

If during step 3 the CANopen device detects that index and sub-index of the mapped object does not exist or the object cannot be mapped the CANopen device shall respond with the SDO abort transfer service (abort code: 0602 0000_h or 0604 0041_h).

If during step 4 the CANopen device detects that the RPDO mapping is not valid or not possible the CANopen device shall respond with the SDO abort transfer service (abort code: 0602 0000_h or 0604 0042_h).

If the CANopen device receives a PDO that is having more data bytes than the number of mapped data bytes is (length), then the CANopen device shall use the first data bytes up to the length and may be initiate the EMCY write service, if supported.

If a CANopen device receives a PDO that is having less data bytes than the number of mapped data bytes (length), then the CANopen device shall initiate the EMCY write service, if supported, with the error code 8210_h.

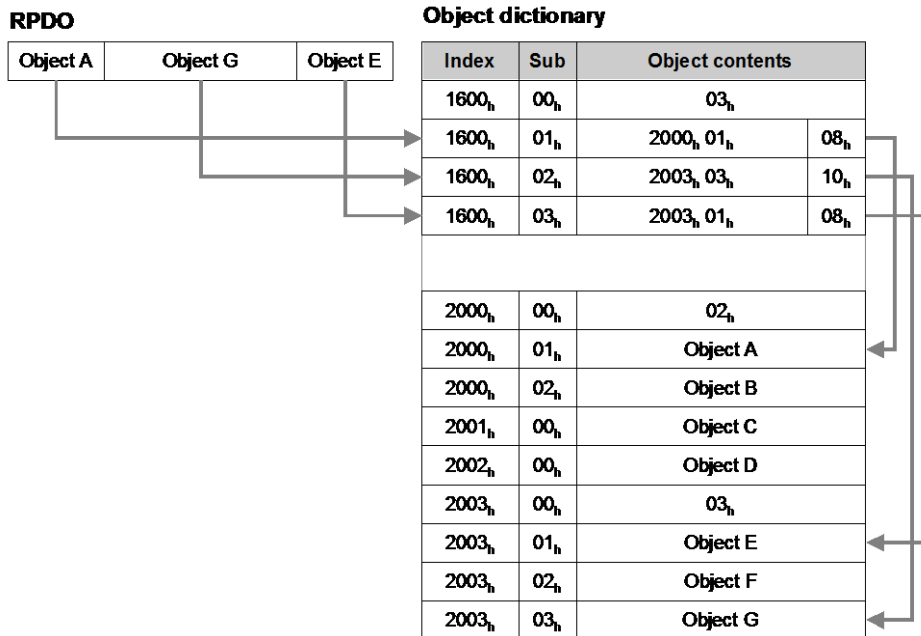


Figure: Principle of RPDO mapping

OBJECT DESCRIPTION

Index	1600 _h to 1607 _h
Name	RPDO mapping parameter
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional; Mandatory for each supported PDO

ENTRY DESCRIPTION

Sub-index	00 _h
Description	number of mapped application objects in PDO
Entry category	Mandatory
Access	rw; const, if mapping is not changeable
PDO mapping	No
Value range	see value definition

Default value	profile- or manufacturer-specific
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Sub-index	01 _h
Description	1 st application object
Entry category	Mandatory
Access	rw; const, if mapping entry is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific

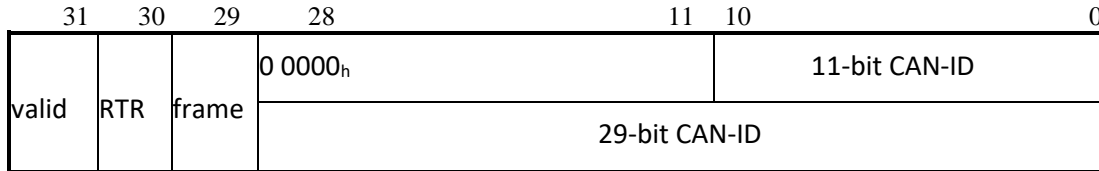
Sub-index	02 _h to 08 _h
Description	2 nd application object to 8 th application object
Entry category	Optional
Access	rw; const, if mapping entry is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific

IV.1.23 Object 1800_h to 1807_h TPDO communication parameter

This object contains the communication parameters for the PDOs the CANopen device is able to transmit.

VALUE DEFINITION

Sub-index 00_h contains the number of valid object entries within the record. Its value is at least 02_h. If inhibit time supported the value is 03_h and if event timer is supported the value is 05_h. Sub-index 01_h contains the COB-ID of the TPDO.



Bit(s)	Value	Description
valid	0 _b	PDO exists / is valid
	1 _b	PDO does not exist / is not valid
RTR	0 _b	RTR allowed on this PDO
	1 _b	no RTR allowed on this PDO
frame	0 _b	11-bit CAN-ID valid (CAN base frame)
	1 _b	29-bit CAN-ID valid (CAN extended frame)
29-bit CAN-ID	x	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	x	11-bit CAN-ID of the CAN base frame

The bit valid (bit 31) allows selecting which TPDOs are used in the NMT state Operational. There may be PDOs fully configured (e.g., by default) but not used, and therefore set to "not valid" (deleted). The feature is necessary for CANopen devices supporting more than 4 TPDOs, because each CANopen device has only default CAN-IDs for the first four TPDOs in the generic pre-defined connection set. CANopen devices supporting the CAN base frame type only or do not support RTRs, an attempt to set bit 29 (frame) to 1_b or bit 30 (RTR) to 0_b is responded with the SDO abort transfer service (abort code: 0609 0030_h). It is not allowed to change bit from 0 to 29 while the PDO exists and is valid (bit 31 = 0_b). CANopen devices supporting the enabling (bit 31 = 0_b) and disabling (bit 31 = 1_b) of a TPDO only shall respond with the SDO abort transfer service (abort code: 0609 0030_h or 0800 000_h) on an attempt to change the values from bit 0 to bit 30. If the CANopen device has implemented one or more device profiles the generic pre-defined connection set shall apply.

Table: Generic pre-defined connection set for TPDO

Index	Default value
1800 _h	CAN-ID: 180 _h + Node-ID frame: 0 _b RTR: profile- or manufacturer-specific valid: profile- or manufacturer-specific
1801 _h	CAN-ID: 280 _h + Node-ID frame: 0 _b RTR: profile- or manufacturer-specific valid: profile- or manufacturer-specific

1802 _h	CAN-ID: 380 _h + Node-ID frame: 0 _b RTR: profile- or manufacturer-specific valid: profile- or manufacturer-specific
Index	Default value
1803 _h	CAN-ID: 480 _h + Node-ID frame: 0 _b RTR: profile- or manufacturer-specific valid: profile- or manufacturer-specific
1804 _h to 1807 _h	CAN-ID: profile- or manufacturer-specific (see clause 7.3.5) to frame: profile- or manufacturer-specific RTR: profile- or manufacturer-specific valid: 1 _b or defined by application profile

If the CANopen device has implemented an application profile the specific pre-defined connection set of that application profile shall apply.

Sub-index 02_h defines the transmission character of the TPDO (see Table 72). An attempt to change the value of the transmission type to any not supported value shall be responded with the SDO abort transfer service (abort code: 0609 0030_h).

Table: Description of TPDO transmission type

Value	Description
00 _h	synchronous (acyclic)
01 _h	synchronous (cyclic every sync)
02 _h	synchronous (cyclic every 2 nd SYNC)
03 _h	synchronous (cyclic every 3 rd SYNC)
04 _h	synchronous (cyclic every 4 th SYNC)
.....
F0 _h	synchronous (cyclic every 240 th SYNC)
F1 _h	reserved
.....
FB _h	reserved
FC _h	RTR-only (synchronous)
FD _h	RTR-only (event-driven)
FE _h	Always (if inhibit time elapsed)
FF _h	On data change (if inhibit time elapsed)

- Synchronous means that the PDO is transmitted after the SYNC. The CANopen device will start sampling of the data with the reception of the SYNC (see Figure 72). In case it is acyclic the CANopen device internal event is given and with the next SYNC the sampling is started and the PDO is transmitted afterwards. In case it is cyclic

- the sampling is started with the reception of every SYNC, every 2nd SYNC, every 3rd SYNC, and s.o. depending on the given value and the PDO is transmitted afterwards.
- RTR-only means that the PDO is not transmitted normally it shall be requested via RTR. In case it is synchronous the CANopen device will start sampling with the reception of every SYNC and then will buffer the PDO (see Figure 72). In case it is event-driven the CANopen device will start sampling with the reception of the RTR and will transmit the PDO immediately.
 - Event-driven means that the PDO may be transmitted at any time based on the occurrence of a CANopen device internal event. The definition of the event does not fall into the scope of this specification and may be specified in device profiles and application profiles.

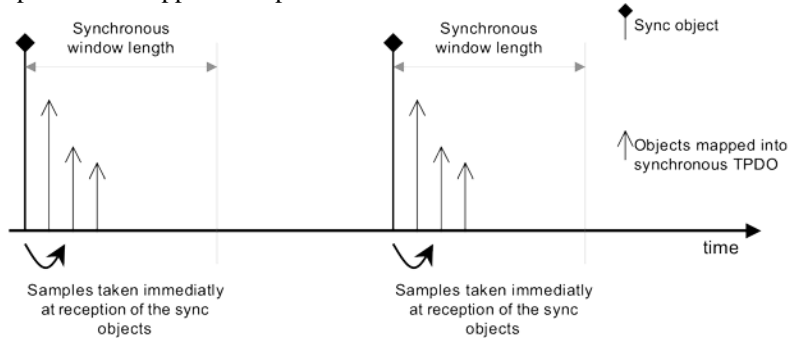


Figure: Bus synchronization and sampling

Sub-index 03_h contains the inhibit time. The time is the minimum interval for PDO transmission if the transmission type is set to FE_h and FF_h. The value is defined as multiple of 100 μs. The value of 0 shall disable the inhibit time. The value shall not be changed while the PDO exists (bit 31 of sub-index 01_h is set to 0_b).

Sub-index 04_h is reserved. It does shall not be implemented; in this case read or write access leads to the SDO abort transfer service (abort code: 0609 0011_h).

Sub-index 05_h contains the event-timer. The time is the maximum interval for PDO transmission if the transmission type is set to FE_h and FF_h. The value is defined as multiple of 1 ms. The value of 0 shall disable the event-timer.

Sub-index 06_h contains the SYNC start value. The SYNC start value of 0 shall indicate that the counter of the SYNC message shall not be processed for this PDO. The SYNC start value 1 to 240 shall indicate that the counter of the SYNC message shall be processed for this PDO. In case the counter of the SYNC message is not enabled sub-index 06_h shall be ignored. The SYNC message of which the counter value equals the SYNC start value shall be regarded as the first received SYNC message. The value shall not be changed while the PDO exists (bit 31 of sub-index 01_h is set to 0_b).

NOTE if the CANopen device detects on switch into the NMT state operational that the SYNC counter value received is higher than the SYNC start value, then the CANopen device has to wait a full cycle until the correct SYNC counter is received.

OBJECT DESCRIPTION

Index	1800 _h to 1807 _h
Name	TPDO communication parameter
Object code	RECORD
Data type	PDO communication parameter record
Category	Conditional; Mandatory for each supported TPDO

ENTRY DESCRIPTION

Sub-index	00 _h
Description	highest sub-index supported

Entry category	Mandatory
Access	const
PDO mapping	No
Value range	02 _h to 05 _h

Sub-index	01 _h
Description	COB-ID used by TPDO
Entry category	Mandatory
Access	rw; const, if COB-ID is not changeable
PDO mapping	No
Value range	see value definition
Default value	see value definition

Sub-index	02 _h
Description	transmission type
Entry category	Mandatory
Access	rw; const, if transmission type is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific

Sub-index	03 _h
Description	inhibit time
Entry category	Optional
Access	rw; const, if inhibit time is not changeable
PDO mapping	No
Value range	see value definition

Default value	profile- or manufacturer-specific
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Sub-index	04 _h
Description	reserved
Entry category	Optional
Access	rw
PDO mapping	No
Value range	UNSIGNED8
Default value	manufacturer-specific

Sub-index	05 _h
Description	event timer
Entry category	Optional
Access	rw; const, if event timer is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific

Sub-index	06 _h
Description	SYNC start value
Entry category	Optional
Access	rw; const, if SYNC start value is not changeable
PDO mapping	No
Value range	UNSIGNED8
Default value	profile- or manufacturer-specific

IV.1.24 Object 1A00_h to 1A07_h TPDO mapping parameter

This object contains the mapping for the PDOs the device is able to transmit.

VALUE DEFINITION

Sub-index 00_h contains the number of valid object entries within the mapping record or a specific value, e.g., if MPDO is supported. The number of valid object entries shall be the number of the application objects that shall be transmitted with the corresponding TPDO.

Table: TPDO mapping values

Value	Description
00 _h	Mapping disabled
01 _h	Sub-index 01 _h valid
02 _h	Sub-index 01 _h and 02 _h valid
03 _h	Sub-index from 01 _h to 03 _h valid
Value	Description
04 _h	Sub-index from 01 _h to 04 _h valid
.....
40 _h	Sub-index from 01 _h to 40 _h valid
41 _h	reserved
.....
FD _h	reserved
FE _h	SAM-MPDO
FF _h	DAM-MPDO

Sub-index from 01_h to 40_h contains the information of the mapped application objects. The object describes the content of the PDO by their index, sub-index and length. The length contains the length of the application object in bit. This may be used to verify the mapping.

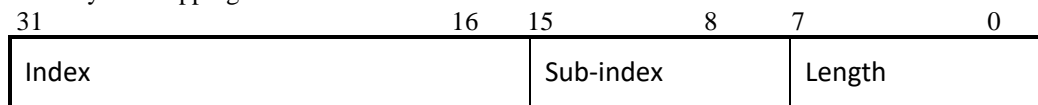


Figure: Structure of TPDO mapping

An attempt to change the value of an object entry to any value that is not supported shall be responded with the SDO abort transfer service. The cause for a not supported value could be the mapping (index and sub-index) of a non-existing application object, a wrong length for the mapped application object, or a wrong length for the PDO at all.

The following procedure shall be used for re-mapping, which may take place during the NMT state Pre-operational and during the NMT state Operational, if supported:

1. Destroy TPDO by setting bit *valid* to 1_b of sub-index 01_h of the according TPDO communication parameter.
2. Disable mapping by setting sub-index 00_h to 00_h.
3. Modify mapping by changing the values of the corresponding sub-indices.
4. Enable mapping by setting sub-index 00_h to the number mapped objects.
5. Create TPDO by setting bit *valid* to 0_b of sub-index 01_h of the according TPDO communication parameter.

If during step 3 the CANopen device detects that index and sub-index of the mapped object does not exist or the object cannot be mapped the CANopen device shall respond with the SDO abort transfer service (abort code: 0602 0000_h or 0604 0041_h).

If during step 4 the CANopen device detects that the RPDO mapping is not valid or not possible the CANopen device shall respond with the SDO abort transfer service (abort code: 0602 0000_h or 0604 0042_h).

Object dictionary

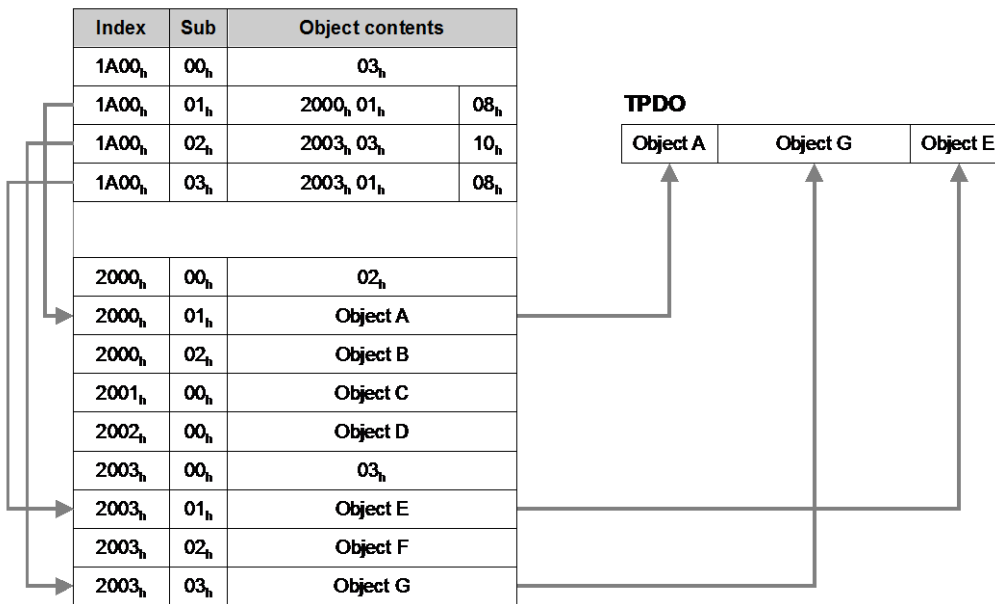


Figure: Principle of TPDO mapping

OBJECT DESCRIPTION

Index	1A00 _h to 1A07 _h
Name	TPDO mapping
Object code	RECORD
Data type	PDO mapping parameter record
Category	Conditional; Mandatory for each supported PDO

ENTRY DESCRIPTION

Sub-index	00 _h
Description	number of mapped application objects in TPDO
Entry category	Mandatory
Access	rw; const, if PDO mapping is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific

Sub-index	01 _h
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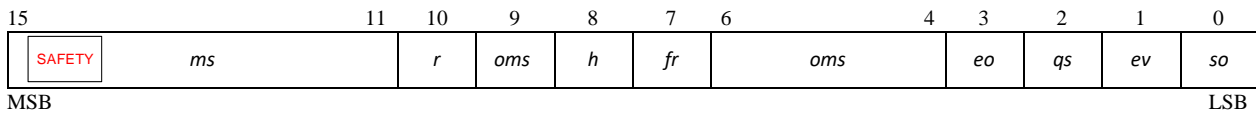
Description	1 st application object
Entry category	Mandatory
Access	rw; const, if PDO mapping entry is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific

Sub-index	02 _n to 08 _n
Description	2 nd application object to 08 th application object
Entry category	Optional
Access	rw; const, if PDO mapping entry is not changeable
PDO mapping	No
Value range	see value definition
Default value	profile- or manufacturer-specific


IV.2 DS402 Drive profile specific object

IV.2.1 Object 6040_h: Controlword

This object shall indicate the received command controlling the PDS FSA. It shall be structured as defined bellow.



LEGEND: ms = manufacturer-specific; r = reserved; oms = operation mode specific; h = halt; fr = fault reset; eo = enable operation; qs = quick stop; ev = enable voltage; so = switch on

Command	Bits of the controlword					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
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 (NOTE)
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset		X	X	X	X	15
NOTE Automatic transition to Enable operation state after executing SWITCHED ON state functionality.						

Bits 9, 6, 5, and 4 of the Controlword are operation mode specific. The halt function (bit 8) behaviour is operation mode specific. If the bit is 1, the commanded motion shall be interrupted, the PDS shall behave as defined in the halt option code. After releasing the halt function, the commanded motion shall be continued if possible. The bit 10 is reserved for further use; it shall be set to 0. The bits 11, 12, 13, 14, and 15 are manufacturer-specific. The bit 15 indicate if STO input is active.

Object description

Attribute	Value
Index	6040 _h
Name	Controlword
Object Code	Variable
Data Type	Unsigned16
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 27
Default Value	Device and operation mode specific

IV.2.2 Object 6041_h: Statusword

This object shall provide the status of the PDS FSA. The object shall be structured as defined below.

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

LEGEND: 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	PDS FSA state
xxxx xxxx x0xx 0000 _b	Not ready to switch on
xxxx xxxx x1xx 0000 _b	Switch on disabled
xxxx xxxx x01x 0001 _b	Ready to switch on
xxxx xxxx x01x 0011 _b	Switched on
xxxx xxxx x01x 0111 _b	Operation enabled
xxxx xxxx x00x 0111 _b	Quick stop active
xxxx xxxx x0xx 1111 _b	Fault reaction active
xxxx xxxx x0xx 1000 _b	Fault

If bit 4 (voltage enabled) of the statusword is 1, this shall indicate that high voltage is applied to the PDS.

If bit 5 (quick stop) of the statusword is 0, this shall indicate that the PDS is reacting on a quick stop request.

If bit 7 (warning) of the statusword is 1, this shall indicate the presence of a warning condition. Warning is not an error or fault (examples: temperature limit exceeded, job refused). The status of the PDS FSA shall not be changed. The cause of the warning may be given in the *fault code parameter* object (603F_h).

If bit 9 (remote) of the statusword is 1, this shall indicate that the controlword is processed. If it is 0 (local), this shall indicate that the controlword is not processed. Nevertheless, the PDS may provide actual values, and the PDS may accept COB for configuration data transmission for other parameter objects.

If bit 10 (target reached) of the statusword is 1, this shall indicate that the PDS has reached the set-point. The set-point is operation mode specific and is defined in detail in the corresponding clauses of this part of the IEC 61800-7 series. Bit 10 shall also be set to 1, if the operation mode has been changed. The change of a target value by software shall alter this bit. If quick stop option code is 5, 6, 7 or 8, bit 10 shall be set to 1, when the quick stop operation is finished and the PDS is halted. If halt occurred and the PDS has halted then bit 10 shall be set to 1, too.

If bit 11 (internal limit active) of the statusword is 1, this shall indicate that an internal limit is active (example: position range limit). The internal limits are manufacturer-specific.

Bit 13 and bit 12 of the statusword are operation mode specific.

Bit 14 is manufacturer-specific: In PV and CST: MaxSpeed Error (refer to Operating mode)

Bit 15 is manufacturer specific: SAFETY: Set if a safety input is in default

Object description

Attribute	Value
Index	6041 _h
Name	Statusword
Object Code	Variable
Data Type	Unsigned16
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 30
Default Value	No

IV.2.3 Object 603F_h: Error code

This object shall provide the error code of the last error which occurred in the drive device.

NOTE In CANopen networks, this object provides the same information as the lower 16-bit of sub-index 01_h of the pre-defined error field (1003_h).

Object description

Attribute	Value
Index	603F _h
Name	Error code
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See V-DS402 Error Code (EMCY frame)
Default Value	No

IV.2.4 Object 6007_h: Abort connection option code

This object shall indicate what action shall be performed when one of the following events occurs: bus-off, heartbeat, life guarding, NMT stopped state entered, reset application, and reset communication.

Value definition

Value	Definition
-32 768 to -1	Manufacturer-specific: See bellow
0	No action
+1	Fault signal
+2	Disable voltage command
+3	Quick stop command
+4 to +32 767	reserved

Object description

Attribute	Value
Index	6007 _h
Name	Abort connection option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 35
Default Value	+1

When this object has positive value, then action is applied for both BusOff, Heartbeat/Lifeguard/NMT state change action.

When negative value, bit field allow to distinguish action according event source:

Bit	16	15-14	13-12	11-10	9-0
CAN	1	BusOff	Heartbeat/Lifeguard	NMT state change (To INIT, STOPPED, RESET)	x xxxx xxxx
ECAT	1	x	x	State from OP to any other	x xxxx xxxx
Profinet	1	Cable unplug	x	B40 internal error	x xxxx xxxx
PowerLink	1	TBD	TBD	TBD	x xxxx xxxx
EthernetIP	1	TBD	TBD	TBD	x xxxx xxxx
Generated Error	x	E23 - 0x8140 n	E23 - 0x8130 n	E20 - 0x81000	x

Coded value on 2 bits:

0: No Action

1: Fault Signal

2: Disable voltage

3: QuickStop

IV.2.5 Object 605A_n: Quick stop option code

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

Value definition

Value	Definition
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 current limit and transit into Switch On Disabled
+4	Slow down on 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 current limit and stay in Quick Stop Active
+8	Slow down on voltage limit and stay in Quick Stop Active
+9 to +32 767	reserved

Object description

Attribute	Value
Index	605A _n
Name	Quick stop option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _n
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 38
Default Value	+2

IV.2.6 Object 605B_h: 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.

Value definition

Value	Definition
0	Disable drive function (switch-off the drive power stage)
+1	Slow down with slow down ramp; disable of the drive function
+2 to +32 767	reserved

Object description

Attribute	Value
Index	605B _h
Name	Shutdown option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 41
Default Value	0

IV.2.7 Object 605C_h: 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.

Value definition

Value	Definition
0	Disable drive function (switch-off the drive power stage)
+1	Slow down with slow down ramp; disable of the drive function
+2 to +32 767	reserved

Object description

Attribute	Value
Index	605C _h
Name	Disable operation option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 44
Default Value	+1

IV.2.8 Object 605D_h: 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.

Value definition

Value	Definition
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 stay in Operation Enabled
+5 to +32 767	Reserved

Object description

Attribute	Value
Index	605D _h
Name	Halt option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 47
Default Value	+1

IV.2.9 Object 605E_n: 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.

Value definition

Value	Definition
0	Disable drive function, motor is free to 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 to +32 767	reserved

Object description

Attribute	Value
Index	605E _n
Name	Fault reaction option code
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _n
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 50
Default Value	+2

IV.2.10 Object 6060_h: Modes of operation

This object shall indicate the requested operation mode. Table 53 specifies the value definition, Table 54 specifies the object description, and Table 55 specifies the entry description.

NOTE: This object shows only the value of the requested operation mode, the actual operation mode of the PDS is reflected in the object modes of operation display.

Value definition

Value	Definition
0	No mode change/no mode assigned
+1	Profile position mode
+2	Velocity mode
+3	Profile velocity mode
+4	Torque profile mode
+5	reserved
+6	Homing mode
+7	Interpolated position mode
+8	Cyclic sync position mode
+9	Cyclic sync velocity mode
+10	Cyclic sync torque mode
+11	Cyclic sync torque mode with communication angle (defined in ECAT ETG.6010)
+12	Auto tuning mode
+13 to +127	Reserved
-1	Gear Box mode
-2	Homing Master mode
-3	Asynchronous Motor (Velocity mode V/F)

Object description

Attribute	Value
Index	6060 _h
Name	Modes of operation
Object Code	Variable
Data Type	Integer8
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 53
Default Value	0

IV.2.11 Object 6061_h: Modes of operation display

This object shall provide the actual operation mode.

Object description

Attribute	Value
Index	6061 _h
Name	Modes of operation display
Object Code	Variable
Data Type	Integer8
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 53
Default Value	No

IV.2.12 Object 6502_h: Supported drive modes

This object shall provide information on the supported drive modes.

31	16 15	10	9	8	7	6	5	4	3	2	1	0
<i>Manufacturer-specific</i>	<i>(reserved)</i>	<i>cst</i>	<i>csv</i>	<i>csp</i>	<i>ip</i>	<i>hm</i>	<i>r</i>	<i>tq</i>	<i>pv</i>	<i>vl</i>	<i>pp</i>	

cst, csv, csp, ip, hm, tq, pv, vl, and pp bits:

1 = function is supported 0 = function is not supported

Manufacturer Specific:

- Bit 16: Auto Tuning Mode
- Bit 17: GearBox Mode
- Bit 18: Homing Master mode

Object description

Attribute	Value
Index	6502 _h
Name	Supported drive modes
Object Code	Variable
Data Type	Unsigned32
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	See Figure 8
Default Value	No

IV.2.13 Object 608F_h: Position encoder resolution

This object shall indicate the configured encoder increments and number of motor revolutions. The position encoder resolution shall be calculated by the following formula:

$$positionencoderresolution = \frac{encoderincrements}{motorrevolutions}$$

All values shall be dimensionless.

Object description

Attribute	Value
Index	608F _h
Name	Position encoder resolution
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01 _h
Description	Encoder increments
Entry Category	Mandatory
Access	Rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02 _h
Description	Motor revolutions
Entry Category	Mandatory
Access	Rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32

Default Value	Manufacturer-specific (but not equal to 0)

IV.2.14 Object 6090_h: Velocity encoder resolution

This object shall indicate the configured encoder increments per second and motor revolutions per second. The velocity encoder resolution shall be calculated by the following formula:

$$\text{velocity encoder resolution} = \frac{\text{Increments encoder/Second}}{\text{revolutions/motor second}}$$

All values shall be dimensionless.

Object description

Attribute	Value
Index	6090 _h
Name	Velocity encoder resolution
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01 _h
Description	Encoder increments per second
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02 _h
Description	Motor revolutions per second
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32

Default Value	Manufacturer-specific (but not equal to 0)

IV.2.15 Object 6091_h: Gear ratio

This object shall indicate the configured number of motor shaft revolutions and number of driving shaft revolutions. The gear ratio shall be calculated by the following formula:

$$\text{gear ratio} = \text{motor shaft revolutions} / \text{driving shaft revolutions}$$

All values shall be dimensionless.

Object description

Attribute	Value
Index	6091 _h
Name	Gear ratio
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01 _h
Description	Motor revolutions
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02 _h
Description	Shaft revolutions
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)



IV.2.16 Object 6092_h: Feed constant

This object shall indicate the configured feed constant, this is the measurement distance per one revolution of the output shaft of the gearbox. The feed constant shall be calculated by the following formula:

$$\text{feed constant} = \text{feed} / \text{driving shaft revolutions}$$

The feed shall be given in user-defined position units, and the driving shaft revolution shall be dimensionless.

Object description

Attribute	Value
Index	6092 _h
Name	Feed constant
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	01 _h
Description	Feed
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)
Sub-Index	02 _h
Description	Shaft revolutions
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301

Value Range	Unsigned32
Default Value	Manufacturer-specific (but not equal to 0)

IV.2.17 Object 6096_h: Velocity factor

This object can be used to match the velocity units to the user-defined velocity units.

Object description

Attribute	Value
Index	6096 _h
Name	Velocity factor
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Numerator
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	1 to 2 ³² -1
Default Value	1
Sub-Index	02 _h
Description	Divisor
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	1 to 2 ³² -1
Default Value	1

IV.2.18 Object 6097_h: Acceleration factor

This object can be used to match the acceleration units to the user-defined acceleration units.

Object description

Attribute	Value
Index	6097 _h
Name	Acceleration factor
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Numerator
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	1 to 2 ³² -1
Default Value	1
Sub-Index	02 _h
Description	Divisor
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	1 to 2 ³² -1
Default Value	1

IV.2.19 Object 60A2_h: Jerk factor

This object can be used to match the jerk units to the user-defined jerk units.

Object description

Attribute	Value
Index	60A2 _h
Name	Jerk factor
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Numerator
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	1 to 2 ³² -1
Default Value	1
Sub-Index	02 _h
Description	Divisor
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	1 to 2 ³² -1
Default Value	1

IV.2.20 Object 607E_h: Polarity

This object shall indicate if the position demand value shall be multiplied by 1 or by -1. The polarity flag shall have no influence on the homing mode. The position polarity bit shall be used only for profile position (*pp*) mode and cyclic sync position mode (*csp*). The velocity polarity bit shall be used only for profile velocity (*pv*) mode and cyclic sync velocity mode (*csv*).

This polarity is called “high level” polarity. User can revert the “Low level” polarity on motor side and on feedback side on specific manufacturer object. (Refer to the motor parameters and to the Feedback parameters)

7	6	5	4	0
Position polarity	Velocity polarity	Torque polarity	reserved (0)	

The polarity bits shall be coded as follows: 0_b = multiply by 1 and 1_b = multiply by -1

Object description

Attribute	Value
Index	607E _h
Name	Polarity
Object Code	Variable
Data Type	Unsigned8
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	See Figure 9
Default Value	00 _h

IV.2.21 Object 607A_h: Target position

This object shall indicate the commanded 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 value of this object shall be interpreted as absolute or relative depending on the 'abs/rel' flag in the controlword. It shall be given in user-defined position units and shall be converted to position increments.

Object description

Attribute	Value
Index	607A _h
Name	Target position
Object Code	Variable
Data Type	Integer32
Category	Optional; mandatory if <i>pp</i> , <i>pc</i> or <i>csp</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

IV.2.22 Object 607B_h: Position range limit

This object shall indicate the configured maximal and minimal position range limits. It shall limit the numerical range of the input value. On reaching or exceeding these limits, the input value shall wrap automatically to the other end of the range. Wrap-around of the input value may be prevented by setting software position limits as defined in software position limit object (607D_h). The values shall be given in user-defined position units.

Then Range is enabled if Min <> Max on the writing of the object 607B.2 only.

Object description

Attribute	Value
Index	607B _h
Name	Position range limit
Object Code	Array
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	Manufacturer-specific
Sub-Index	01 _h
Description	Min position range limit
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific
Sub-Index	02 _h
Description	Max position range limit
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301

Value Range	Integer32
Default Value	Manufacturer-specific

IV.2.23 Object 607D_h: 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. Every new target position shall be checked against these limits. The limit positions shall be always relative to the machine home position. Before being compared with the target position, they shall be corrected internally by the home offset as follows:

$$\text{corrected min position limit} = \text{min position limit} - \text{home offset} \quad \text{corrected max position limit} = \text{max position limit} - \text{home offset}$$

This calculation needs only be performed when home offset or software position limit is changed. The limit positions shall be given in user-defined position units (same as target position).

Then Range is enabled if Min <> Max on the writing of the object 607D.2 only.

Object description

Attribute	Value
Index	607D _h
Name	Software position limit
Object Code	Array
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	Manufacturer-specific
Sub-Index	01 _h
Description	Min position limit
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

Sub-Index	02 _h
Description	Max position limit
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

IV.2.24 Object 607F_h: Max profile velocity

This object shall indicate the configured maximal allowed velocity in either direction during a profiled motion. The value shall be given in the very same physical unit as the *profile velocity* object (6081_h).

Object description

Attribute	Value
Index	607F _h
Name	Max profile velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.25 Object 6080_h: Max motor speed

This object shall indicate the configured maximal allowed speed for the motor in either direction. It is used to protect the motor and is taken from the motor data sheet. The value shall be given in rotations per minute (rpm).

Object description

Attribute	Value
Index	6080 _h
Name	Max motor speed
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.26 Object 6081_h: Profile velocity

This object shall indicate the configured velocity normally attained at the end of the acceleration ramp during a profiled motion and shall be valid for both directions of motion. allowed velocity in either direction during a profiled motion. The value shall be given in user defined speed units. It shall be converted to position increments per second using the *velocity encoder factor* object.

Object description

Attribute	Value
Index	6081 _h
Name	Profile velocity
Object Code	Variable
Data Type	Unsigned32
Category	Conditional: mandatory if <i>pp</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.27 Object 6082_h: End velocity

This object shall indicate the configured velocity, which the drive shall have on reaching the target position. Normally, the drive stops at the target position, i.e. the end velocity = 0. The value shall be given in the same physical unit as the *profile velocity* object (6081_h).

Object description

Attribute	Value
Index	6082 _h
Name	End velocity
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32

Default Value	0000 0000 _h
---------------	------------------------

IV.2.28 Object 6083_h: Profile acceleration

This object shall indicate the configured acceleration. The value shall be given in user-defined acceleration units; it shall be converted to position increments per square second (s²) using the normalising factors.

Object description

Attribute	Value
Index	6083 _h
Name	Profile acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Conditional: mandatory if <i>pp</i> or <i>pv</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.29 Object 6084_h: Profile deceleration

This object shall indicate the configured deceleration. If this parameter is not supported, then the *profile acceleration* object (6083_h) value shall be used for deceleration, too. The value shall be given in the same physical units as *profile acceleration* object (6083_h).

Object description

Attribute	Value
Index	6084 _h
Name	Profile deceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.30 Object 6085_h: Quick stop deceleration

This object shall indicate the configured deceleration used to stop the motor when the quick stop function is activated and the *quick stop code* object (605A_h) is set to 2 or 6. The quick stop deceleration is also used if the *fault reaction code* object (605E_h) is 2 and the *halt option code* object (605D_h) is 2. The value shall be given in the same physical unit as *profile acceleration* object (6083_h).

Object description

Attribute	Value
Index	6085 _h
Name	Quick stop deceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.31 Object 6086_h: Motion profile type

This object shall indicate the configured type of motion profile used to perform a profiled motion.

Value definition

Value	Definition
-1	Jerk-limited ramp (in %)
0	Linear ramp (trapezoidal profile)
+1	Sin ² ramp
+2	Jerk-free ramp
+3 to +32 767	Reserved

Object description

Attribute	Value
Index	6086 _h
Name	Motion profile type
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0

IV.2.32 Object 60A3_h: Profile jerk use

This object shall indicate the configured number of sub-indices used in the *profile jerk* object (60A4_h) for the jerk profile movement. If this object is not implemented, the *profile jerk* object shall be used as it is implemented. The value shall be dimensionless, the value of FF_h shall indicate that the profile jerk use is not configured.

Object description

Attribute	Value
Index	60A3 _h
Name	Profile jerk use
Object Code	Variable
Data Type	Unsigned8
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	01 _h to 02 _h and FF _h
Default Value	Manufacturer-specific

IV.2.33 Object 60A4_h: Profile jerk

This object shall indicate the configured set of jerk parameters that shall be used during the profile movement. The values shall be given in user-defined jerk units. If object 60A3_h is not implemented, the sub-index 00_h shall be used to assign the values given in the other sub-indices to the jerks.

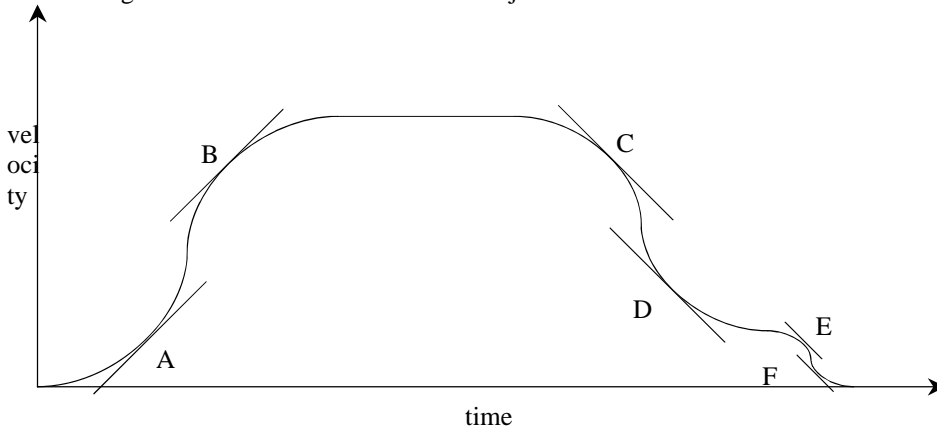


Figure – Velocity/time diagram with jerk positions

Value assignments

Value in 60A3 _h or subindex 00 _h of 60A4 _h if 60A3 _h is not implemented	Value assignment to jerks					
	A	B	C	D	E	F
01 _h	01 _h	01 _h	01 _h	01 _h	-	-
02 _h	01 _h	01 _h	02 _h	02 _h	-	-

Object description

Attribute	Value
Index	60A4 _h
Name	Profile jerk
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	01 _h , 02 _h
Default Value	Manufacturer-specific

Sub-Index	01 _h
Description	Profile jerk 1
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02 _h
Description	Profile jerk 2
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.34 Object 60C5_h: Max acceleration

This object shall indicate the configured maximal acceleration. It is used to limit the acceleration to an acceptable value in order to prevent the motor and the moved mechanics from being destroyed. The value shall be given in user-defined acceleration physical units.

Object description

Attribute	Value
Index	60C5 _h
Name	Max acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.35 Object 60C6_h: Max deceleration

This object shall indicate the configured maximal deceleration. It is used to limit the acceleration to an acceptable value in order to prevent the motor and the moved mechanics from being destroyed. The value shall be given in the same physical unit as the *max acceleration* object (60C5_h).

Object description

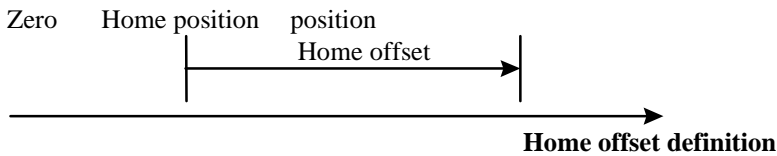
Attribute	Value
Index	60C6 _h
Name	Max deceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.36 Object 607C_h: Home offset

This object shall indicate the configured difference between the zero position for the application and the machine home position (found during homing). During homing, the machine home position is found and once the homing is completed, the zero position is offset from the home position by adding the home offset to the home position. All subsequent absolute moves shall be taken relative to this new zero position. If this object is not implemented, then the home offset shall be regarded as zero. The value of this object shall be given in user-defined position units. Negative values shall indicate the opposite direction.



Object description

Attribute	Value
Index	607C _h
Name	Home offset
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	0 _d

IV.2.37 Object 6098_h: Homing method

This object shall indicate the configured homing method that shall be used.

Value definition

Value	Definition
-128 _d to -1 _d	Manufacturer-specific
0 _d	No homing method assigned
+1 _d	Method 1 shall be used
to	
+35 _d	Method 35 shall be used
+36 _d	Method 36 shall be used
+37 _d	Method 37 shall be used
+38 _d to +127 _d	reserved

Object description

Attribute	Value
Index	6098 _h
Name	Homing method
Object Code	Variable
Data Type	Integer8
Category	Conditional: mandatory if <i>hm</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 109
Default Value	Manufacturer-specific

IV.2.38 Object 6099_h: Homing speeds

This object shall indicate the configured speeds used during homing procedure. The values shall be given in user-defined velocity units.

Object description

Attribute	Value
Index	6099 _h
Name	Homing speeds
Object Code	Array
Data Type	Unsigned32
Category	Conditional: mandatory if <i>hm</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Speed during search for switch
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific
Sub-Index	02 _h
Description	Speed during search for zero
Entry Category	Mandatory
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.39 Object 609A_h: Homing acceleration

This object shall indicate the configured acceleration and deceleration to be used during homing operation. The value shall be given in user-defined acceleration units.

Object description

Attribute	Value
Index	609A _h
Name	Homing acceleration
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.40 Object 6062_h: Position demand value

This object shall provide the demanded position value. The value shall be given in user defined position units.

Object description

Attribute	Value
Index	6062 _h
Name	Position demand value
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.41 Object 6063_h: Position actual internal value

This object shall provide the actual value of the position measurement device, which shall be one of the two input values of the closed-loop position control. If necessary, the data unit may be transformed from user-defined units to increments. The value shall be given in internal units.

Object description

Attribute	Value
Index	6063 _h
Name	Position actual internal value
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.42 Object 6064_h: Position actual value

This object shall provide the actual value of the position measurement device. The value shall be given in user-defined position units.

Object description

Attribute	Value
Index	6064 _h
Name	Position actual value
Object Code	Variable
Data Type	Integer32
Category	Mandatory if <i>csp</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.43 Object 6065_h: Following error window

This object shall indicate the configured range of tolerated position values symmetrically to the position demand value. If the position actual value is out of the following error window, a following error occurs. A following error may occur when a drive is blocked, unreachable profile velocity occurs, or at wrong closed-loop coefficients. The value shall be given in user defined position units. If the value of the following error window is FFFF FFFF_h, the following control shall be switched off.

Object description

Attribute	Value
Index	6065 _h
Name	Following error window
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.44 Object 6066_h: Following error time out

This object shall indicate the configured time for a following error condition, after that the bit 13 of the statusword shall be set to 1. The reaction of the drive when a following error occurs is manufacturer-specific. The value shall be given in ms.

Object description

Attribute	Value
Index	6066 _h
Name	Following error time out
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16

Default Value	Manufacturer-specific
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IV.2.45 Object 6067_h: Position window

This object shall indicate the configured symmetrical range of accepted positions relative to the target position. If the actual value of the position encoder is within the position window, this target position shall be regarded as having been reached. As the user mostly prefers to specify the position window in his application in user-defined units, the value is transformed into increments. The target position shall be handled in the same manner as in the trajectory generator concerning limiting functions and transformation into internal machine units before it may be used with this function. The value shall be given in user-defined position units. If the value of the position window is FFFF FFFF_h, the position window control shall be switched off.

Object description

Attribute	Value
Index	6067 _h
Name	Position window
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.46 Object 6068_h: Position window time

This object shall indicate the configured time, during which the actual position within the position window is measured. The value shall be given in ms.

Object description

Attribute	Value
Index	6068 _h
Name	Position window time
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV

PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

IV.2.47 Object 60F4_h: Following error actual value

This object shall provide the actual value of the following error. The value shall be given in user-defined position units.

Object description

Attribute	Value
Index	60F4 _h
Name	Following error actual value
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.48 Object 60FA_h: Control effort

This object shall provide the control effort as the output of the position control loop. It is particular to the *position control function* that the notation of the control effort is mode dependent and therefore not specified. The value shall be given in user-defined velocity units.

Object description

Attribute	Value
Index	60FA _h
Name	Control effort
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301

Value Range	Integer32
Default Value	No

IV.2.49 Object 60FC_h: Position demand internal value

This object shall provide the output of the trajectory generator in profile position mode. This value shall be given in increments of the position encoder.

Object description

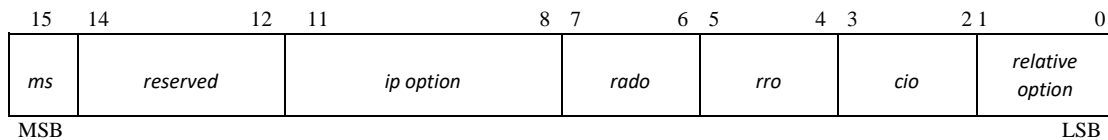
Attribute	Value
Index	60FC _h
Name	Position demand internal value
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.50 Object 60F2_h: Positioning option code

This object shall indicate the configured positioning behaviour as described by the *profile positioning mode* or the *interpolated positioning mode*.



LEGEND *ms* = manufacturer-specific *rro* = request-response option *cio* = change immediately option

Object structure

The *relative option* bits shall control the behaviour of positioning tasks in detail when the *abs_rel* bit (bit 6) of the controlword is set to 1 in *pp* mode.

Value definition for bit 0 and bit 1

Bit 1	Bit 0	Definition
0	0	Positioning moves shall be performed relative to the preceding (internal absolute) target position (rsp. relative to 0 if there is no preceding target position) as described in 10.2
0	1	Positioning moves shall be performed relative to the actual position demand value (object 60FC _h) – output of the trajectory generator
1	0	Positioning moves shall be performed relative to the position actual value (object 6064 _h)
1	1	Reserved

The *change immediately option* bits shall control the behaviour of positioning tasks in detail when the *change_set_immediately* bit (bit 5) of the controlword is set to 1 in *pp* mode.

Value definition for bit 2 and bit 3

Bit 3	Bit 2	Definition
0	0	The drive device shall readapt the actual motion to the new target position (considering potentially changed profile velocity and accelerations etc.) immediately as described in 10.2
0	1	The actually performed positioning task shall be continued (without attempting to stop on target position) and blended to the newly commanded task (considering potentially changed profile velocity and accelerations etc.) when target position is touched
1	0	Reserved
1	1	Reserved

The *request-response option* bits shall allow the drive device to release the *new_setpoint* bit (bit 4) of the controlword internally in order to avoid the need of setting this bit to 0 by the control device in *pp* mode. After internally releasing the *new_setpoint* bit, the drive device shall indicate the action to the control device by setting the *setpoint_acknowledgement* bit (bit 12) in the statusword to 0.

Value definition for bit 4 and bit 5

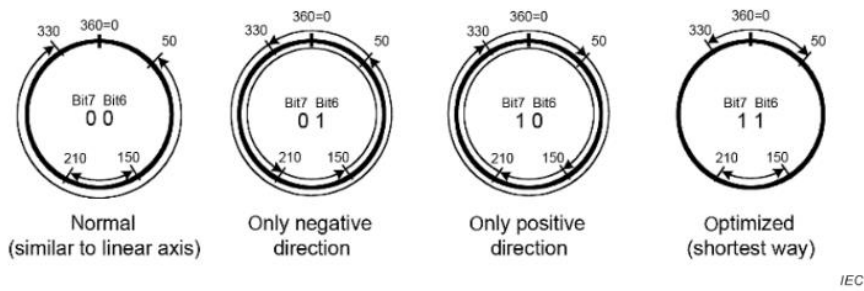
Bit 5	Bit 4	Definition
0	0	The handshake as described in 10.2 shall be performed
0	1	The drive device shall release autonomously the <i>new_setpoint</i> bit as soon as target is reached
1	0	The drive shall release autonomously the <i>new_setpoint</i> bit as soon as able to accept new setpoint data
1	1	Reserved

Controlled rotary axes are needed for rotary tables and conveyor belts. It is also needed for cases where the host controller position limits are wider than the position range limits available in the drive. In these cases, the software position limits (object 607D) are out of the range limit (607B, sub-index 01) and max position range limit (607B, sub-index 02) shall be set to 0. Depending on the application, there are different rotary axis movements possible, which are coded by bit 6 and 7.

Value definition for bit 6 and bit 7

Bit 7	Bit 6	Definition
0	0	Normal positioning similar to linear axis; If reaching or exceeding the position range limits (607B) the input value shall wrap automatically to the other end of the range. Positioning can be relative or absolute. Only with this bit combination, the movement greater than a modulo value is possible.
0	1	Positioning only negative direction; If target position is higher than actual position, axis moves over the min position range (607B, sub-index 01) to the target position.
1	0	Positioning only positive direction; If target position is lower than actual position, axis moves over the max position range (607B, sub-index 02) to the target position.
1	1	Positioning with the shortest way to the target position. NOTE if the difference between actual value and target position in a 360° system is 180°, the axis moves in positive direction.

Figure below show movement examples depending on settings of the bits 6 and 7. Here the min position range limit (607B sub-index 01) is 0° and the max position range limit (607B, sub-index 02) is 360°



The *ip option* bits are reserved for defining the interpolated position mode. When the *manufacturer-specific* bit is set to 0, the function shall be not enabled; if it is set to 1, the manufacturer-specific function shall be enabled. The other reserved bits shall be set to 0.

Object description

Attribute	Value
Index	60F2 _h
Name	Positioning option code
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 150, Table 151, Table 152
Default Value	0000 _h

IV.2.51 Object 60C0_h: Interpolation sub mode select

This object shall indicate the actually chosen interpolation mode.

Value definition

Value	Definition
-1	Spline interpolation
0	Linear interpolation
+1 to +32 767	Reserved

Object description

Attribute	Value
Index	60C0 _h
Name	Interpolation sub mode select
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	See Table 160
Default Value	0

IV.2.52 Object 60C1_h: Interpolation data record

This object shall indicate data words, which are necessary to perform the interpolation algorithm. The number N of data words in the record is defined by interpolation data configuration. The interpretation of the data words in interpolation data record may vary with the different possible interpolation modes as set by the interpolation sub mode select.

For the linear interpolation mode, each interpolation data record simply is regarded as a new position set-point. To describe a cubic spline interpolation, more data words are needed (Refer to Interpolation mode chapter)

User must write all index before write the index 1 which trig the Push of the buffer element.

Object description

Attribute	Value
Index	60C1 _h
Name	Interpolated data record
Object Code	Array
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	01 _h to FE _h
Default Value	No
Sub-Index	01 _h
Description	1st set-point
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific
Sub-Index	02 _h
Description	2nd set-point
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301

Value Range	Integer32
Default Value	Manufacturer-specific
to	
Sub-Index	04 _h
Description	4th set-point
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

IV.2.53 Object 60C2_h: Interpolation time period

This object shall indicate the configured interpolation cycle time. The interpolation time period (sub-index 01_h) value shall be given in 10^(interpolation time index) (second). The interpolation time index (sub-index 02_h) shall be dimensionless.

Object description

Attribute	Value
Index	60C2 _h
Name	Interpolation time period
Object Code	Record
Data Type	Interpolation time period record (0080 _h)
Category	Conditional: mandatory if <i>ip</i> , <i>csp</i> , <i>csv</i> or <i>cst</i> mode is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Interpolation time period value
Entry Category	Mandatory
Access	rw

PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned8
Default Value	01 _h
Sub-Index	02 _h
Description	Interpolation time index
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	-128 to +63
Default Value	-3

IV.2.54 Object 60C4_h: Interpolation data configuration

This object shall provide the maximum buffer size, shall indicate the configured buffer organisation of interpolation data, and shall provide objects to define the size of the data record and to clear the buffers. This object is used to enable the drive device to receive the needed data in advance. It also is used to store the positions and further data sent by the control device.

The value of sub-index 01_h shall be given in number of interpolation data records.

The value of sub-index 02_h shall be given in number of interpolation data records.

If sub-index 03_h is 00_h this shall indicate a FIFO buffer organisation, if it is 01_h this shall indicate a ring buffer organisation. All other values are reserved.

The value of sub-index 04_h shall be dimensionless indicating the next free buffer entry point.

The value of sub-index 05_h shall be given in byte.

If 00_h is written to sub-index 06_h this shall clear the buffer inputs, shall disable the access, and shall clear all *ip* data records. If 01_h is written to sub-index 06_h, this enables access to the input buffers. All other values are reserved.

Object description

Attribute	Value
Index	60C4 _h
Name	Interpolation data configuration
Object Code	Record
Data Type	Interpolation data configuration record (0081 _h)
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported

Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	07 _h
Default Value	07 _h
Sub-Index	01 _h
Description	Maximum buffer size
Entry Category	Mandatory
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	No
Sub-Index	02 _h
Description	Actual buffer size
Entry Category	Mandatory
Access	Ring mode :rw ; Fifo mode: ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	0000 0000 _h

Attribute	Value
Sub-Index	03 _h
Description	Buffer organisation
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	00 _h or 01 _h
Default Value	00 _h
Sub-Index	04 _h
Description	Buffer position
Entry Category	Mandatory
Access	rw

PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	0000 _h
Sub-Index	05 _h
Description	Size of data record
Entry Category	Mandatory
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	01 _h to FE _h
Default Value	01 _h
Sub-Index	06 _h
Description	Buffer clear
Entry Category	Mandatory
Access	wo
PDO Mapping	See IEC 61800-7-301
Value Range	00 _h or 01 _h
Default Value	00 _h

IV.2.55 Object 6069_h: Velocity sensor actual value

This object shall provide the value read from a velocity sensor. The value shall be given in increments per second.

Object description

Attribute	Value
Index	6069 _h
Name	Velocity sensor actual value
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.56 Object 606B_h: Velocity demand value

This object shall provide the output value of the trajectory generator. The value shall be given in the user-defined velocity units.

Object description

Attribute	Value
Index	606B _h
Name	Velocity demand value
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.57 Object 606C_h: Velocity actual value

This object shall provide the actual velocity value derived either from the velocity sensor or the position sensor. The value shall be given in user-defined velocity units.

Object description

Attribute	Value
Index	606C _h
Name	Velocity actual value
Object Code	Variable
Data Type	Integer32
Category	Conditional: mandatory if <i>pv</i> or <i>csv</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	No

IV.2.58 Object 606D_h: Velocity window

This object shall indicate the configured velocity window. The value shall be given in user defined velocity units.

Object description

Attribute	Value
Index	606D _h
Name	Velocity window
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

IV.2.59 Object 606E_h: Velocity window time

This object shall indicate the configured velocity window time. The value shall be given in milliseconds.

Object description

Attribute	Value
Index	606E _h
Name	Velocity window time
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	0000 _h

IV.2.60 Object 606F_h: Velocity threshold

This object shall indicate the configured velocity threshold. The value shall be given in user-defined velocity units.

Object description

Attribute	Value
Index	606F _h
Name	Velocity threshold
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

IV.2.61 Object 6070_h: Velocity threshold time

This object shall indicate the configured velocity threshold time. The value shall be given in milliseconds.

Object description

Attribute	Value
Index	6070 _h
Name	Velocity threshold time
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

IV.2.62 Object 60FF_h: 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 user-defined velocity units.

Object description

Attribute	Value
Index	60FF _h
Name	Target velocity
Object Code	Variable
Data Type	Integer32
Category	Conditional: mandatory if <i>pv</i> or <i>csv</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	Manufacturer-specific

IV.2.63 Object 6071_h: Target torque

This object shall indicate the configured input value for the torque controller in profile torque mode. The value shall be given per thousand of rated torque.

Object description

Attribute	Value
Index	6071 _h
Name	Target torque
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory if <i>tq</i> or <i>cst</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0000 _h

IV.2.64 Object 6072: Max torque

This object shall indicate the configured maximum permissible torque in the motor. The value shall be given per thousand of rated torque.

Object description

Attribute	Value
Index	6072 _h
Name	Max torque
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

IV.2.65 Object 6073_h: Max current

This object shall indicate the configured maximum permissible torque creating current in the motor. The value shall be given per thousand of rated current.

Object description

Attribute	Value
Index	6073 _h
Name	Max current
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned16
Default Value	Manufacturer-specific

IV.2.66 Object 6074: Torque demand

This object shall provide the output value of the trajectory generator. The value shall be given in 1/1 000 of rated torque.

Object description

Attribute	Value
Index	6074 _h
Name	Torque demand
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

IV.2.67 Object 6075_h: Motor rated current

This object shall indicate the configured motor rated current. It is taken from the motor's name-plate. Depending on the motor and drive technology, this current is DC, peak or r.m.s. (root-mean-square) current. All relative current data refers to this value. The value shall be given in mA.

Object description

Attribute	Value
Index	6075 _h
Name	Motor rated current
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.68 Object 6076: Motor rated torque

This object shall indicate the configured motor rated torque. It is taken from the motor's nameplate. All relative torque data shall refer to this value. For linear motors, the object name is not changed, but the motor rated force value shall be entered as multiples of mN (milli Newton). The value shall be given in mNm (milli Newton metre).

Object description

Attribute	Value
Index	6076 _h
Name	Motor rated torque
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw -NV
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.69 Object 6077_h: Torque actual value

This object shall provide the actual value of the torque. It shall correspond to the instantaneous torque in the motor. The value shall be given per thousand of rated torque.

Object description

Attribute	Value
Index	6077 _h
Name	Torque actual value
Object Code	Variable
Data Type	Integer16
Category	Conditional: mandatory if <i>cst</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

IV.2.70 Object 6078: Current actual value

This object shall provide the actual value of the current. It shall correspond to the current in the motor. The value shall be given per thousand of rated current.

Object description

Attribute	Value
Index	6078 _n
Name	Current actual value
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _n
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	No

IV.2.71 Object 6079_h: DC link circuit voltage

This object shall provide the instantaneous DC link current voltage at the drive device. The value shall be given in mV.

Object description

Attribute	Value
Index	6079 _h
Name	DC link circuit voltage
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	No

IV.2.72 Object 6087: Torque slope

This object shall indicate the configured rate of change of torque. The value shall be given in units of per thousand of rated torque per second.

Object description

Attribute	Value
Index	6087 _h
Name	Torque slope
Object Code	Variable
Data Type	Unsigned32
Category	Conditional: mandatory if <i>tq</i> is supported

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	Manufacturer-specific

IV.2.73 Object 6088_h: Torque profile type

This object shall indicate the configured type of profile used to perform a torque change.

Value definition

Value	Definition
0000 _h	Linear ramp (trapezoidal profile)
0001 _h	sin ² ramp
0002 _h to 7FFF _h	Reserved

Object description

Attribute	Value
Index	6088 _h
Name	Torque profile type
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0000 _h

IV.2.74 Object 60B0_h: Position offset

This object shall provide the offset of the target position. The offset shall be given in user-defined position units.

NOTE: The value itself is absolute and thus independent of how often it is transmitted over the communication system, for example, transmitted twice does not mean double value. Since the additive position value represents an offset to the target position, it can be also used to control the drive with relative values with regard to the target position.

Object description

Attribute	Value
Index	60B0 _h
Name	Position offset
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	0

IV.2.75 Object 60B1_h: Velocity offset

This object shall provide the offset for the velocity value. The offset shall be given in user-defined velocity units. 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.

NOTE The value itself is absolute and thus independent of how often it is transmitted over the communication system, for example transmitted twice does not mean double value. Since the additive velocity value represents an offset to the target velocity, it can be also used to control the drive with relative values with regard to the target velocity.

Object description

Attribute	Value
Index	60B1 _h
Name	Velocity offset
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	Rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer32
Default Value	0

IV.2.76 Object 60B2_h: Torque offset

This object shall provide the offset for the torque value. The offset shall be given in per thousand rated torque. In cyclic synchronous position mode and cyclic synchronous velocity, 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.

NOTE The value itself is absolute and thus independent of how often it is transmitted over the communication system, for example transmitted twice does not mean double value.

Object description

Attribute	Value
Index	60B2 _h
Name	Torque offset
Object Code	Variable
Data Type	Integer16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Integer16
Default Value	0

IV.2.77 Object 60B8_h: Touch probe function

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

Object structure

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1 (Note: Object 0x2400 Must enable the capture function on input)
1	0	Trigger first event
	1	continuous
2	0	Trigger with touch probe 1 input
	1	Trigger with zero impulse signal or position encoder (Not available in SMD)
3	0	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 negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6, 7	-	Reserved
8	0	Switch off touch probe 2
	1	Enable touch probe 2 (Note: Object 0x2400 Must enable the capture function on input)
9	0	Trigger first event
	1	continuous
10	0	Trigger with touch probe 2 input
	1	Trigger with zero impulse signal or position encoder (Not available in SMD)
11	0	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 negative edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
14, 15	-	Reserved

Object description

Attribute	Value
Index	60B8 _h
Name	Touch probe function
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	rw
PDO Mapping	See IEC 61800-7-301
Default Value	0

IV.2.78 Object 60B9_h: Touch probe status

This object shall provide the status of the touch probe.

Object structure

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 value stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 negative edge value stored
3 to 7	0	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 value stored
10	0	Touch probe 2 no negative edge value stored
11 to 15	0	Reserved

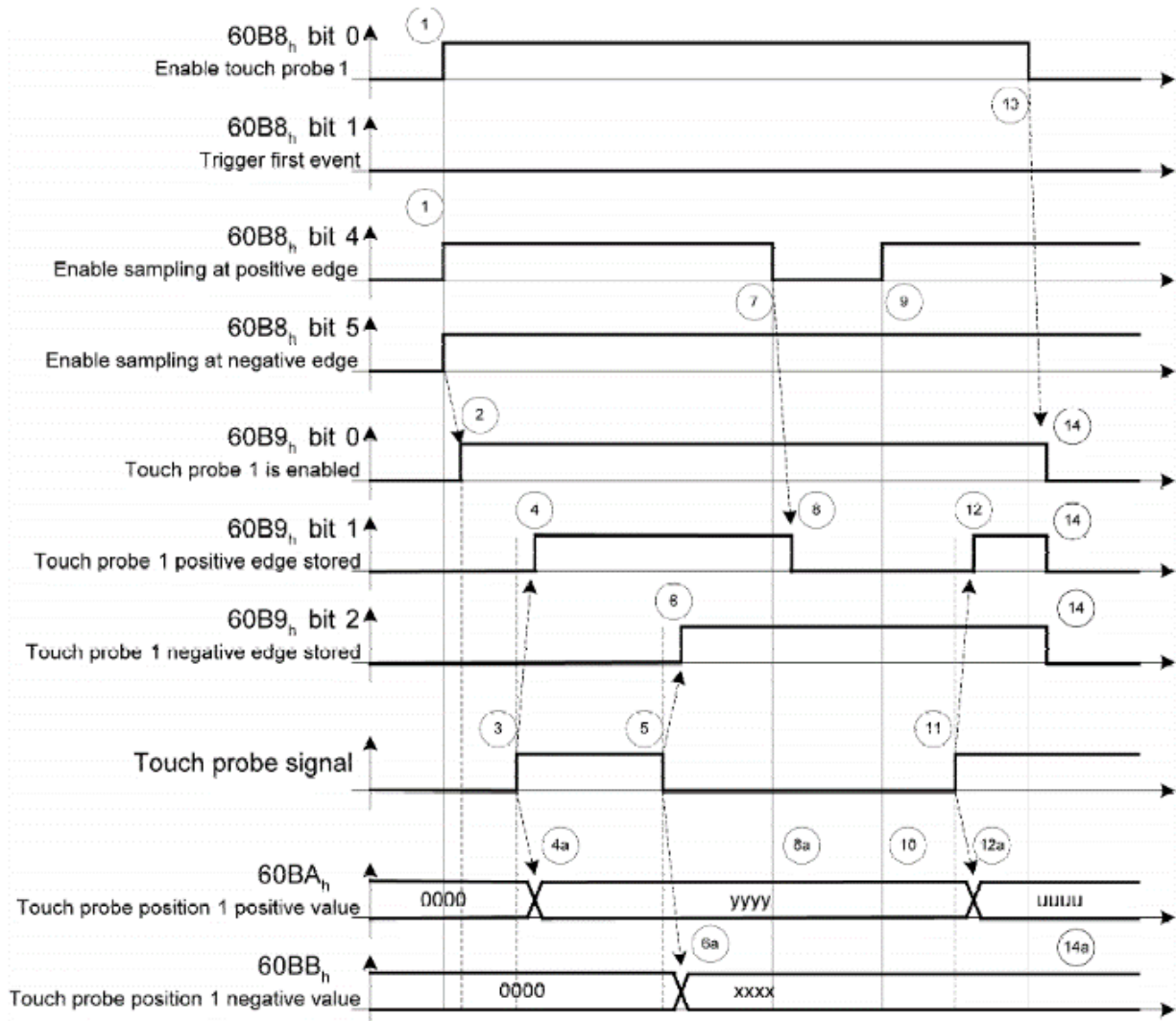
Object description

Attribute	Value
Index	60B9 _h
Name	Touch probe status
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

Time diagram



Number	Touch probe behavior	
(1)	60B8 _h , bit 0 = 1 _b	Enable touch probe 1
	60B8 _h , bit 1, 4, 5	Configure and enable touch probe 1 positive and negative edge
(2)	→ 60B9 _h , bit 0 = 1 _b	Status "Touch probe 1 enabled" is set
(3)	External touch probe signal has positive edge	
(4)	→ 60B9 _h , bit 1 = 1 _b	Status "Touch probe 1 positive edge stored" is set
(4a)	→ 60BA _h	Touch probe position 1 positive value is stored
(5)	External touch probe signal has negative edge	
(6)	→ 60B9 _h , bit 2 = 1 _b	Status "Touch probe 1 negative edge stored" is set
(6a)	→ 60BB _h	Touch probe position 1 negative value is stored
(7)	60B8 _h , bit 4 = 0 _b	Sample positive edge is disabled
(8)	→ 60B9 _h , bit 0 = 0 _b	Status "Touch probe 1 positive edge stored" is reset
(8a)	→ 60BA _h	Touch probe position 1 positive value is not changed
(9)	60B8 _h , bit 4 = 1 _b	Sample positive edge is enabled
(10)	→ 60BA _h	Touch probe position 1 positive value is not changed
(11)	External touch probe signal has positive edge	
(12)	→ 60B9 _h , bit 1 = 1 _b	Status "Touch probe 1 positive edge stored" is set
(12a)	→ 60BA _h	Touch probe position 1 positive value is stored
(13)	60B8 _h , bit 0 = 0 _b	Touch probe 1 is disabled
(14)	→ 60B9 _h , bit 0, 1, 2 = 0 _b	Status bits are reset
(14a)	→ 60BA _h , 60BB _h	Touch probe position 1 positive/negative value are not changed

IV.2.79 Object 60BA_h: Touch probe 1 Positive edge

This object shall provide the Position value of the touch probe 1 at positive edge. The value shall be given in user-defined position units.

Object description

Attribute	Value
Index	60BA _h
Name	Touch probe positive edge
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.80 Object 60BB_h: Touch probe 1 Negative edge

This object shall provide the Position value of the touch probe 1 at negative edge. The value shall be given in user-defined position units.

Object description

Attribute	Value
Index	60BB _h
Name	Touch probe negative edge
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.81 Object 60BC_h: Touch probe 2 Positive edge

This object shall provide the Position value of the touch probe 2 at positive edge. The value shall be given in user-defined position units.

Object description

Attribute	Value
Index	60BC _h
Name	Touch probe positive edge
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.82 Object 60BD_h: Touch probe 2 Negative edge

This object shall provide the Position value of the touch probe 2 at negative edge. The value shall be given in user-defined position units.

Object description

Attribute	Value
Index	60BD _h
Name	Touch probe negative edge
Object Code	Variable
Data Type	Integer32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.83 Object 60D1_h: Touch probe time stamp 1 Positive value

This object shall provide the time stamp value of the touch probe 1 at positive edge. The value shall be given nanoseconds.

Object description

Attribute	Value
Index	60D1 _h
Name	Touch probe time stamp 1 positive edge
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.84 Object 60D2_h: Touch probe time stamp 1 Negative value

This object shall provide the time stamp value of the touch probe 1 at negative edge. The value shall be given nanoseconds.

Object description

Attribute	Value
Index	60D2 _h
Name	Touch probe time stamp 1 negative edge
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.85 Object 60D3_h: Touch probe time stamp 2 Positive value

This object shall provide the time stamp value of the touch probe 2 at positive edge. The value shall be given nanoseconds.

Object description

Attribute	Value
Index	60D3 _h
Name	Touch probe time stamp 2 positive edge
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.86 Object 60D4_h: Touch probe time stamp 2 Negative value

This object shall provide the time stamp value of the touch probe 2 at negative edge. The value shall be given nanoseconds.

Object description

Attribute	Value
Index	60D4 _h
Name	Touch probe time stamp 2 negative edge
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.87 Object 60D5_h: Touch probe 1 Positive edge counter

This object shall provide a continuous counter that is incremented with each positive edge at touch probe 1. The counter is only valid if the touch probe input is enabled (0x60B8 bit 0 = 1). For single event measuring only the value of bit 0 shall be evaluated. For continuous measuring the value is an unsigned 16-bit value with overflow.

Object description

Attribute	Value
Index	60D5 _h
Name	Touch probe 1 positive edge counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.88 Object 60D6_h: Touch probe 1 Negative edge counter

This object shall provide a continuous counter that is incremented with each negative edge at touch probe 1. The counter is only valid if the touch probe input is enabled (0x60B8 bit 0 = 1). For single event measuring only the value of bit 0 shall be evaluated. For continuous measuring the value is an unsigned 16-bit value with overflow.

Object description

Attribute	Value
Index	60D6 _h
Name	Touch probe 1 negative edge counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.89 Object 60D7_h: Touch probe 2 Positive edge counter

This object shall provide a continuous counter that is incremented with each positive edge at touch probe 2. The counter is only valid if the touch probe input is enabled (0x60B8 bit 8 = 1). For single event measuring only the value of bit 0 shall be evaluated. For continuous measuring the value is an unsigned 16-bit value with overflow.

Object description

Attribute	Value
Index	60D7 _h
Name	Touch probe 2 positive edge counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.90 Object 60D8_h: Touch probe 1 Negative edge counter

This object shall provide a continuous counter that is incremented with each negative edge at touch probe 2. The counter is only valid if the touch probe input is enabled (0x60B8 bit 8 = 1). For single event measuring only the value of bit 0 shall be evaluated. For continuous measuring the value is an unsigned 16-bit value with overflow.

Object description

Attribute	Value
Index	60D8 _h
Name	Touch probe 2 negative edge counter
Object Code	Variable
Data Type	Unsigned16
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Default Value	No

IV.2.91 Object 60FD_h: Digital inputs

This object shall provide digital inputs. Refer to object 0x2400 and 0x2401 for specific input function.

31	16 15	4	3	2	1	0
Bit16: Capture 1 Bit17: Capture 2 Bit18: STOA Bit 19: STOB Bit 20 to 29: Extension board TOR I1...I10	reserved	interlock	home switch	positive limit switch	negative limit switch	
MSB						LSB

For SMD specific Version Only

31	16 15	4	3	2	1	0
Reserved	reserved	ETOR1	ETOR2	positive limit switch	negative limit switch	
MSB						LSB

Object structure

Value definition

Value	Definition
0 _b	Switched off
1 _b	Switched on

Object description

Attribute	Value
Index	60FD _h
Name	Digital inputs
Object Code	Variable
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	0000 0000 _h

IV.2.92 Object 60FE_h: Digital outputs

This object shall command simple digital outputs. Refer to object 0x20402 for specific output function.

31	16 15	1	0
Manufacturer-specific Bit 16: Q1 24V/1A (Base version: Relay, specific version 24V/1A) Bit 17 to 22: Tor 24V/0.5A (For specific version S1 to S6) Bit 23 to 30: Tor of extension serial board (S3 to S10)		reserved	set brake (Q2)
MSB		LSB	

Object structure

Value definition

Value	Definition for sub-index 01 _h	Definition for sub-index 02 _h
0b	Switch off/don't set brake	Disable output
1b	Switch on/set brake	Enable output

Object description

Attribute	Value
Index	60FE _h
Name	Digital output
Object Code	Array
Data Type	Unsigned32
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	See IEC 61800-7-301
Value Range	02 _h or 02 _h
Default Value	Manufacturer-specific
Sub-Index	01 _h
Description	Physical outputs
Entry Category	Mandatory
Access	rw
PDO Mapping	See IEC 61800-7-301

Value Range	Unsigned32
Default Value	0000 0000 _h
Sub-Index	02 _h
Description	Bit mask
Entry Category	Optional
Access	rw
PDO Mapping	See IEC 61800-7-301
Value Range	Unsigned32
Default Value	0000 0000 _h

IV.3 EtherCAT CoE specific object

Specific object added by EtherCAT group specifications are added to the basic communication profile object.

IV.3.1 Object 10F1_h: Error settings

Defines the Error Settings object used for Error Reaction behaviour of the slave.

Object description

Attribute	Value
Index	10F1 _h
Name	Error Settings
Object Code	Record
Category	optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Local Error reaction
Access	rw
Value Range	Unsigned32
Default Value	1
Sub-Index	02 _h
Description	Sync Error counter limit
Access	rw
Value Range	Unsigned16
Default Value	4

10F1.01 only support the value 1: “Disable SyncManager (outputs) from PDI side and go to ErrSafeOp”

10F1.02: Limit set by the master when slave shall change its EtherCAT State to SAFEOP with AL Status Code 0x1A. The Slave shall reset its internal error counter when it is synchronized again and confirms the state transition from SAFEOP to OP.

For more detail, refer to ETG.1020 specifications.

IV.3.2 Object 10F8_h: Error settings

The Timestamp object holds the current local Time of the slave.
Value: Local Timestamp of the device in ns.

Object description

Attribute	Value
Index	10F8 _h
Name	Timestamp Object
Object Code	Variable
Category	Optional

Entry description

Attribute	Value
Sub-Index	00 _h
Access	ro
PDO Mapping	yes
Value Range	Unsigned64
Default Value	0000 0000 _h

IV.3.3 Object 1C00_h: Sync manager communication type

This allows to see/configure the communication type for each of the 4 available Sync Manager. This behaviour is fixed and defined as follow Sub-Index description:

Object description

Attribute	Value
Index	1C00 _h
Name	Sync Manager Communication Type
Object Code	Array
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
Value Range	04 _h
Default Value	04 _h
Sub-Index	01 _h
Description	Communication Type Sync Manager 1
Access	ro
Value Range	Unsigned8
Default Value	1: Mailbox receive (master to slave)
Sub-Index	02 _h
Description	Communication Type Sync Manager 2
Access	ro
Value Range	Unsigned8
Default Value	2: Mailbox send (slave to master)
Sub-Index	03 _h
Description	Communication Type Sync Manager 3
Access	ro
Value Range	Unsigned8
Default Value	3: process data output
Sub-Index	04 _h
Description	Communication Type Sync Manager 4

Access	ro
Value Range	Unsigned8
Default Value	4: process data input (Slave to master)

IV.3.4 Object 1C12_h,1C13_h: Rx/Tx PDO assign

The PDO Assign object is used to describe which PDOs shall be transmitted with the EtherCAT input and output Data.

The RxPDOs of the module will be assigned in the order of the modules in the RxPDO Assign Object 0x1C12 as shown in the following table.

Subindex	Assigned RxPDO
1	RxPDO Mapping Index of 1st Module with Outputs
2	RxPDO Mapping Index of 2nd Module with Outputs
...	
n	RxPDO Mapping Index of last Module with Outputs
n+1	optional: 1st RxPDO Mapping Index of the device
n+2	optional: 2nd RxPDO Mapping Index of the device
...	...

Subindex	Assigned TxPDO
1	TxPDO Mapping Index of 1st Module with Inputs
2	TxPDO Mapping Index of 2nd Module with Inputs
...	
n	TxPDO Mapping Index of last Module with Inputs
n+1	optional: 1st TxPDO Mapping Index of the device
n+2	optional: 2nd TxPDO Mapping Index of the device
...	...

IV.3.5 Object 1C32_h,1C33_h: Sync Parameters Objects

The Sync Manager Parameter objects contain information about the synchronization behaviour of the device. If no outputs are transmitted in SAFE-OP and OP (Sync Manager Channel 2 is disabled), the Subindex 0 of object 0x1C32 return 0 in SAFE-OP and OP. The other subindexes return the Abort-Code 0x06090011.

If no inputs are transmitted in SAFE-OP and OP (Sync Manager Channel 3 is disabled), the Subindex 0 of object 0x1C33 return 0 in SAFE-OP and OP. The other subindexes return the Abort-Code 0x06090011.

The different synchronization types can be identified by the different combinations of the Subindexes of 0x1C32 and 0x1C33 as shown below.

Sync Mode	Synchroni- zation Type	Synchroni- zation Type	Output Shift Time	Input Shift Time	Calc and Copy Time	Calc and Copy Time	Delay Time	Delay Time	Fixed Sync0 Cycle Time
	0x1C32 SI 01	0x1C33 SI 01	0x1C32 SI 03	0x1C33 SI 03	0x1C32 SI 06	0x1C33 SI 06	0x1C32 SI 09	0x1C33 SI 09	
Free Run Mode									
Free Run ²	0x00	0x00	--	--	--	--	--	--	--
SM Event Mode									
SM2 ²	0x01	0x22	--	--	--	--	--	--	--
SM3 ²	--	0x01	--	--	--	--	--	--	--
SM2, Shift Input Latch ²	0x01	0x22	--	!=0 ³	--	!=0	--	--	--
SM3, Shift Input Latch ²	--	0x01	--	!=0 ³	--	!=0	--	--	--
DC Mode									
DC Sync0	0x02	0x02	--	--	>=0	!=0	>=0	--	--
DC Sync0, Shift Outputs Valid and Input Latch	0x02	0x02	>=0 ³	>=0 ³	!=0	!=0	>=0	--	--
DC, Shift of Input Latch with Sync1	0x02	0x03	--	--	!=0	!=0	>=0	>=0	--
DC Sync1	0x03	0x03	--	--	!=0	!=0	>=0	--	--
Subordinated Application Controller Cycles									
DC, Shift Outputs Valid/ Input Latch	0x03	0x02 or 0x03	>=0 ³	>=0 ³	>=0	!=0	>=0	>=0	!=0

Refer to ETG1020 to see more function of this register.

IV.3.6 Object F000_h: Modular device Profile

The Module Device Profile object contains all information to interpret the objects in Object Areas of the modules. The object is read-only and not PDO mappable.

Object description

Attribute	Value
Index	F000 _h
Name	Modular Device Profile
Object Code	Record
Category	optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
Value Range	02 _h
Default Value	02 _h
Sub-Index	01 _h
Description	Index distance
Access	ro
Value Range	Unsigned16
Default Value	0x800
Sub-Index	02 _h
Description	Maximum number of modules
Access	ro
Value Range	Unsigned16
Default Value	1

Subindex 1 indicate the distance between two modules (Maximum number of objects per module an area)

Subindex 2 indicate the maximum number of modules

IV.3.7 Object F010_h: Module Profile List

The module Profiles list contains the profile information of each module.

Object description

Attribute	Value
Index	F010 _h
Name	Module Profile List
Object Code	Record
Category	optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
Value Range	01 _h
Default Value	01 _h
Sub-Index	01 _h
Description	Index distance
Access	ro
Value Range	Unsigned32
Default Value	0x20192

IV.3.8 Object F030_h: Configured Module Ident List

The Configured Module Ident List contains the module ident numbers of the configured modules as show in the table below. The EtherCAT Master should download the Module Ident List so that the EtherCAT slave can compare the expected module configuration.

Object description

Attribute	Value
Index	F030 _h
Name	Configured Ident List
Object Code	Record
Category	optional

Entry description

Attribute	Value
Sub-Index	00 _h
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
Value Range	01 _h
Default Value	01 _h
Sub-Index	01 _h
Description	Index distance
Access	Rw (W in PreOp)
Value Range	Unsigned32
Default Value	0x00219800

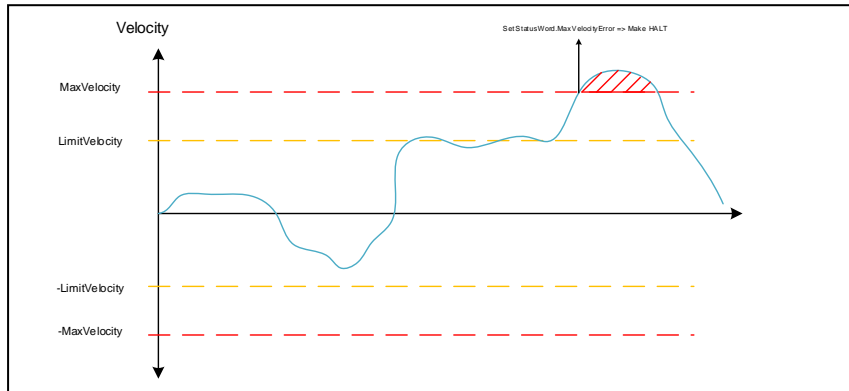
IV.4 Manufacturer specific object

IV.4.10x2000 – Torque Control

In torque control (CST or PT mode) this object shall indicate the limit and maximum velocity. Limit allow to specify a regulation to this speed if no torque is applied to the axe.

Maximum velocity defines a threshold which will trig a halt signal.

Unit is on User Defined Velocity.



Object description

Attribute	Value
Index	0x2000
Name	Torque Control
Object Code	Record
Data Type	Unsigned32
Category	mandatory if cst mode or pt mode is supported

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory if cst mode or pt mode is supported
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	Limit velocity
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	unsigned32 (in V.u.d)
Default Value	0x00
Sub-Index	0x02
Description	Maximum velocity
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	unsigned32 (in V.u.d)
Default Value	0x00

Limit velocity:
0 = Not activated
else indicate the velocity limit in V.u.d

Max velocity:
0 = Not activated
else indicate the velocity Max in V.u.d

IV.4.20x2001 – SmartAbs / Tamagawa

SmartAbs is the name of the serial protocol to motor absolute multi turn coder.
This object allows to get some information about its status.

Object description

Attribute	Value
Index	0x2001
Name	SmartAbs
Object Code	Record
Data Type	Unsigned8
Category	mandatory if SmartAbs coder is present

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory if cst mode or pt mode is supported
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	Communication Status
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Manufacturer-specific
Default Value	0x00
Sub-Index	0x02
Description	Battery Status
Entry Category	Mandatory
Access	ro
PDO Mapping	TX
Value Range	Manufacturer-specific
Default Value	0x00
Sub-Index	0x03
Description	Status Field
Entry Category	Mandatory
Access	ro
PDO Mapping	TX
Value Range	Manufacturer-specific
Default Value	0x00
Sub-Index	0x04
Description	ALMC Field
Entry Category	Mandatory
Access	ro
PDO Mapping	TX
Value Range	Manufacturer-specific
Default Value	0x00

Communication Status:

Indicate each step of serial communication. If all is Ok, status is 0x0F.

- Bit0: Tx Echo Received
- Bit1: Rx Received
- Bit2: Rx CF received is the expected
- Bit3: CRC is Ok

Battery Status:

Indicate the status of the connected battery:

- Bit7: Battery Error (On last power Off, battery low under 2.75V)
- Bit8: Battery Alarm (during power On, Battery is under 3.1V)

Status field:

Return last pulled value of the coder Status Field
(Cf §6.3.2 p14 of Specification of Smart-Abs (14.03.2006))

ALMC Field:

Return last pulled value of the ALMC register (Status flag). (Cf §6.5 p20 of Specification of Smart-Abs (14.03.2006))

IV.4.10x2002 – Fault Status

Return the Fault Status which is the current fault present into the Drive. Each bit indicates an error number (E01, E02...)

Object description

Attribute	Value
Index	0x2002
Name	FaultStatus
Object Code	Variable
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	MultiPurpose
Entry Category	Mandatory
Access	rw
PDO Mapping	None
Value Range	[0..65535]
Default Value	0

FaultStatus

Bit 0 indicate if E01 is present, Bit 1 indicate if E02 is present Etc...

E51 is triggered on Bit 0 (E01).

Bit 31 is an unknown error

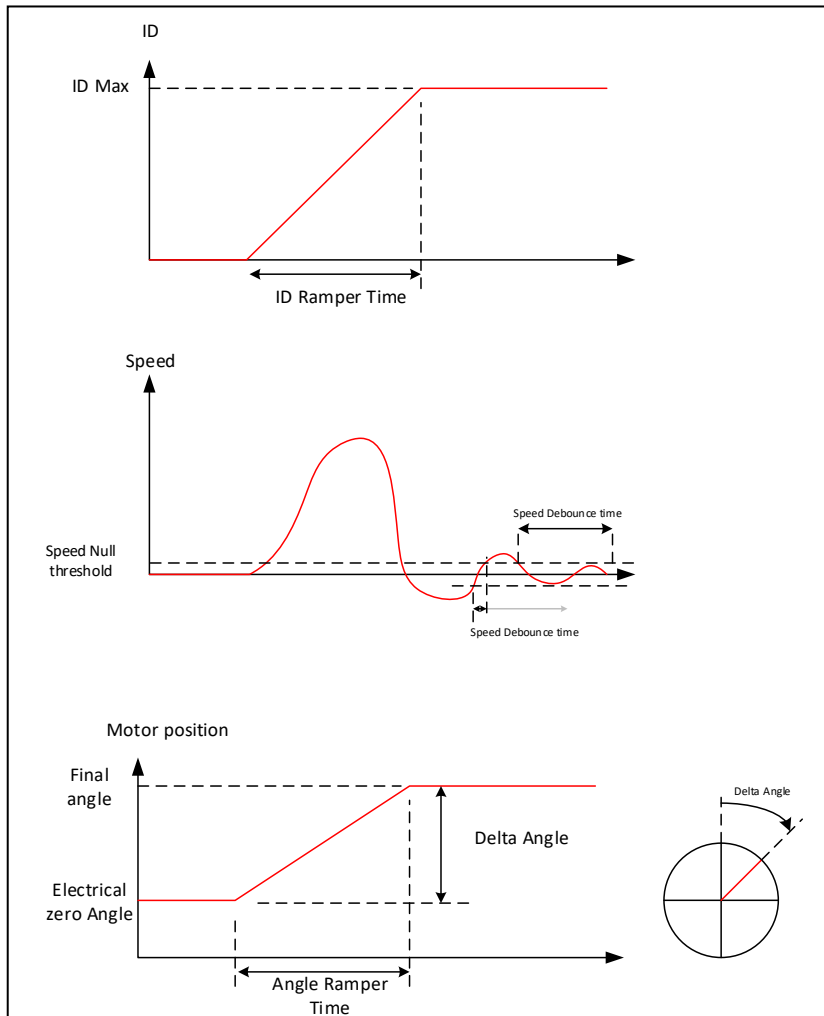
IV.4.20x2100 – Auto Tuning: Zero Search Algorithm

In Autotuning method, the Electrical zero search procedure allow to find the electrical zero of the motor. This object configures some parameters (expert mode) for this search:

During the Zero search, control increase with a ramper the Id current. Then the motor will move and stop when the electrical zero is reach.

We detect this stop with a "Zero" speed threshold during a debounce time.

After that, the control asks to move with a gap angle (Angle set is increased with a ramper profile). According the real move done, we determine the Motor Pole number.



Attribute	Value
Index	0x2100
Name	Zero Search Algorithm
Object Code	Record
Data Type	Unsigned16
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x06
Default Value	0x06
Sub-Index	0x01
Description	Id Max
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	200
Sub-Index	0x02
Description	Id Ramper Time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	1000
Sub-Index	0x03
Description	Delta Angle
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	500
Sub-Index	0x04
Description	Angle Ramper Time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	1000
Sub-Index	0x05
Description	Null Velocity Threshold
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	10
Sub-Index	0x06
Description	Speed Debounce Time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	500

Id Max:
Indicate the ID max to reach on electrical zero search.
The value shall be given per thousand of rated current.

Id Ramper Time:
Indicate the ID ramper time in milliseconds

Delta angle:
Indicate the delta angle to do to determine the pole number. The higher the value, the greater the accuracy.
The value shall be given per thousand of 1 **Electrical** lap.

Angle Ramper Time:
Indicate the Angle ramper time in milliseconds

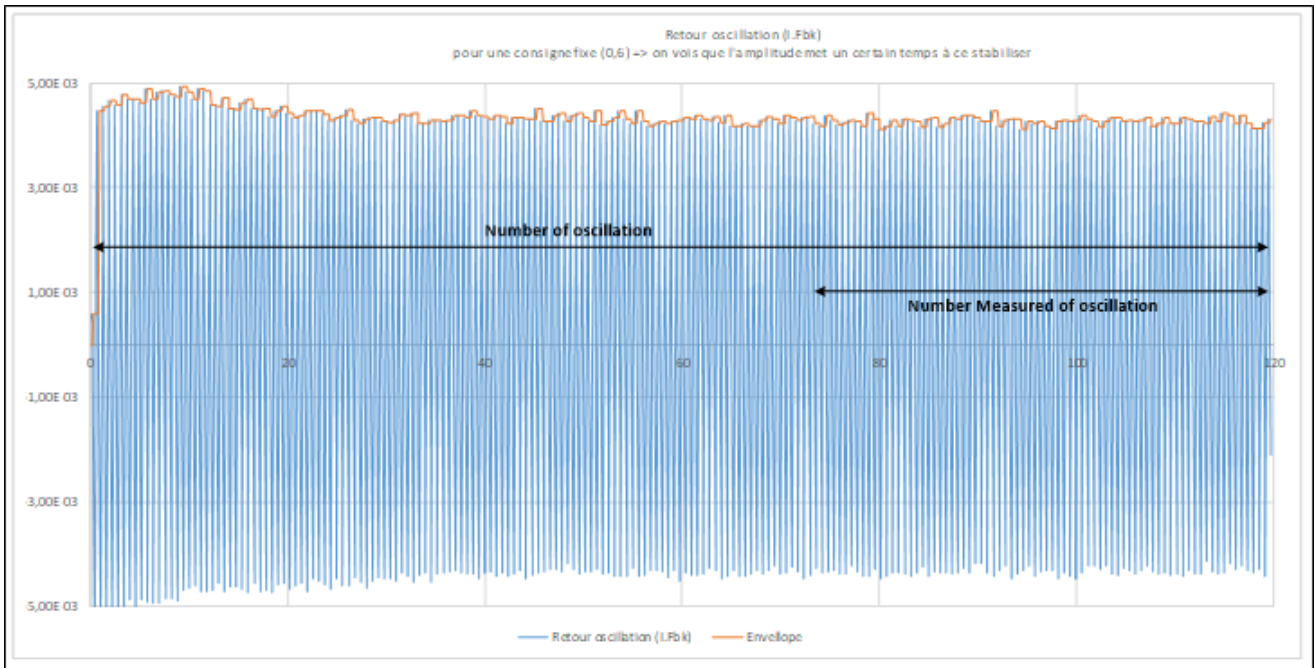
Null Velocity Threshold:
Indicate the threshold under we consider the axe speed as null
Shall be given in User Define Velocity

Note: Also used on Current/Speed/position Loop Algo. Motor Velocity Null is the end condition.

Speed Debounce time:
Indicate the minimum time in milliseconds the speed must stay under the Velocity Threshold to consider axe is stopped.

IV.4.30x2101 – Auto Tuning: Current Loop Algorithm

In Auto Tuning method, the Current Loop Tuning algorithm need some parameters (expert) to be executed.



Object description

Attribute	Value
Index	0x2101
Name	Current Loop Algorithm
Object Code	Record
Data Type	Current Loop Tuning parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x03
Default Value	0x03
Sub-Index	0x01
Description	Voltage Amplitude
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	100
Sub-Index	0x02
Description	Number Of Oscillation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	300
Sub-Index	0x03
Description	Number Of Measured Oscillation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	100

Current Amplitude

Indicate the maximum set of driven oscillation.
Given in per thousand DCBus Voltage

Number Of Oscillation:

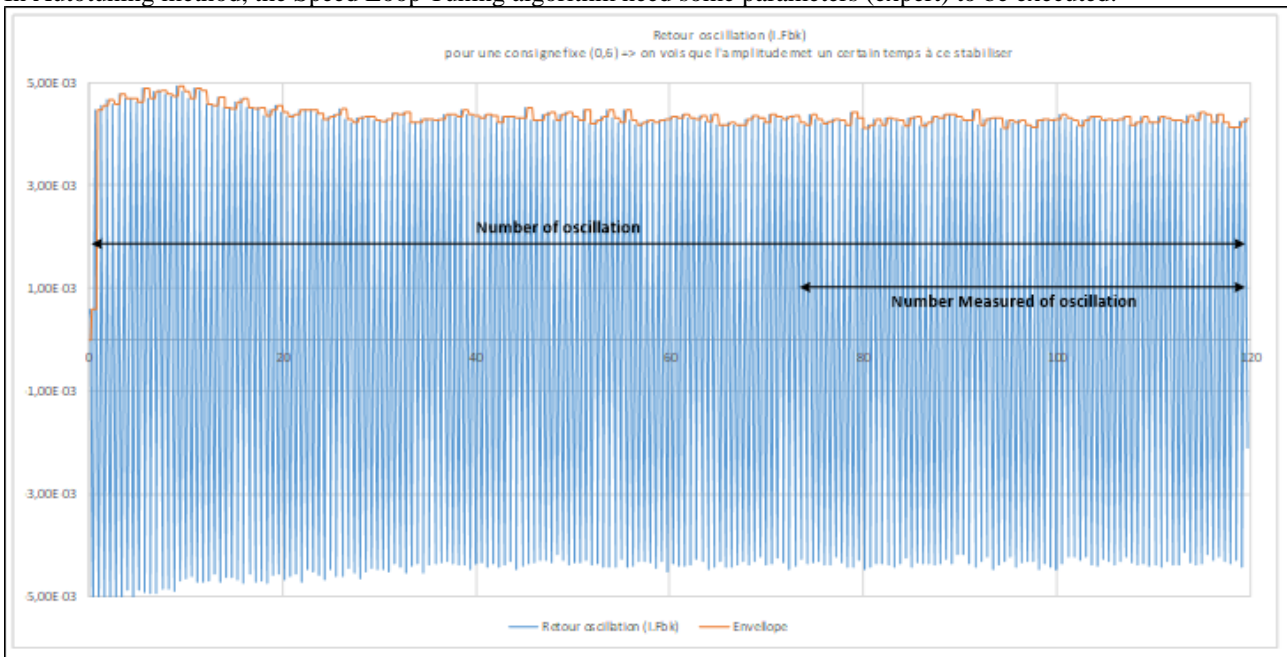
Indicate the number of oscillation to do

Number Of Measured Oscillation:

Indicate the number of oscillation where measure is done.
Measure is done on the last oscillation. So the first oscillation are here to reach a stabilized status.

IV.4.40x2102 - Auto Tuning: Speed Loop Algorithm

In Autotuning method, the Speed Loop Tuning algorithm need some parameters (expert) to be executed.



Object description

Attribute	Value
Index	0x2102
Name	Speed Loop Algorithm
Object Code	Record
Data Type	Speed Loop Tuning parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x03
Default Value	0x03
Sub-Index	0x01
Description	Rated Current Amplitude
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	50
Sub-Index	0x02
Description	Number Of Oscillation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	60
Sub-Index	0x03
Description	Number Of Measured Oscillation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	50

Rated Current Amplitude

Indicate the maximum set of driven oscillation.
Given in per thousand Motor Rated Current (0x6075)

Number Of Oscillation:

Indicate the number of oscillation to do

Number Of Measured Oscillation:

Indicate the number of oscillation where measure is done.
Measure is done on the last oscillation. So the first oscillation are here to reach a stabilized status.

IV.4.50x2103 - Auto Tuning: Position Loop Algorithm

In Autotuning method, the Position Loop Tuning algorithm need some parameters (expert) to be executed. Oscillations are driven with different amplitude (From 0 to a max).

Object description

Attribute	Value
Index	0x2103
Name	Position Loop Algorithm
Object Code	Record
Data Type	Position Loop Tuning parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	Speed Amplitude
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	18
Sub-Index	0x02
Description	Number Of Oscillation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	50
Sub-Index	0x03
Description	Number Of Measured Oscillation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	30
Sub-Index	0x04
Description	Speed Step
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	10

speed Amplitude

Indicate the maximum set of driven oscillation.
Given in per thousand Max Motor Speed (0x6080)
If inflexion is not reach before reach this amplitude, Tuning is stopped

Number Of Oscillation:

Indicate the number of oscillation to do per amplitude

Number Of Measured Oscillation:

Indicate the number of oscillation where measure is done.
Measure is done on the last oscillation. So the first oscillation are here to reach a stabilized status.

Position step:

Indicate the step where position is incremented on each step.
Given in per thousand Max Motor Speed (0x6080)

Not used for the moment....

IV.4.60x2110 – Auto Tuning Set

Allow user to define which type of Current/Speed/position Loop he wants (Slow, Normal, Fast)

Object description

Attribute	Value
Index	0x2110
Name	Auto Tuning Set
Object Code	Record
Data Type	Current Loop Tuning parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	unsigned32
Default Value	0x04
Sub-Index	0x01
Description	Current Loop IQ Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	unsigned32
Default Value	0x1200 0000
Sub-Index	0x02
Description	Current Loop ID Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	unsigned32
Default Value	0x1200 0000
Sub-Index	0x03
Description	Speed Loop Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	unsigned32
Default Value	0x1000 0000
Sub-Index	0x04
Description	Position Loop Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	unsigned32
Default Value	0x1100 0000

Mode:

Indicate the type of loop user want:
 0x10-- ----: Slow response , Fast Integral
 0x11-- ----: Normal response , Fast Integral
 0x12-- ----: Fast response , Fast Integral

 0x20-- ----: Slow response , Slow Integral
 0x21-- ----: Normal response , Slow Integral
 0x22-- ----: Fast response , Slow Integral

0x0aaa abbb

bbb (0..1000) : Response in Per thousand (Expert mode) (0..1000 PerMile)
 aaaa (0..65535): Integral in Per hundred (Expert mode) (0..65535%): If 0, use Kv set to 1.0

		Current Loop	Speed Loop	Position Loop
Proportional	Slow	30%	15%	15%
	Normal	55%	33%	27%
	Fast	130%	60%	40%
Integral	Slow	627%	140%	100%
	Fast	200%	1300%	0% (Kv)

Recommended for Serial Motor

Recommended for Resolver Motor

IV.4.70x2111 – Control Loop parameters

Value used for Control Current/Speed/position loop. These values can be tuned independently (expert) or automatically written after Auto-Tuning method.

Object description

Attribute	Value
Index	0x2111
Name	Control Loop
Object Code	Record
Data Type	Current Loop Tuning parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x0D
Default Value	0x0D
Sub-Index	0x01
Description	Current Loop IQ Kp
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	1.0
Sub-Index	0x02
Description	Current Loop IQ Tau I
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	10.0
Sub-Index	0x03
Description	Current Loop ID Kp
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	1.0
Sub-Index	0x04
Description	Current Loop ID Tau I
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	10.0
Sub-Index	0x05
Description	Current Loop Kv
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	0.0
Sub-Index	0x06
Description	Speed Loop Kp
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	1.0
Sub-Index	0x07
Description	Speed Loop Tau I
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	10.0

Current Loop IQ Kp
Proportional Gain of the Current Loop IQ

Current Loop IQ Tau I
Integral Time constant (in milliseconds) of the Current Loop IQ
Note: Internal $K_i = T_e / T_{auI}$ (With T_e is Sampling time)

Current Loop ID Kp
Proportional Gain of the Current Loop IQ

Current Loop ID Tau I
Integral Time constant (in milliseconds) of the Current Loop IQ
Note: Internal $K_i = T_e / T_{auI}$ (With T_e is Sampling time)

Current Loop Kv
Actual Speed coefficient correction injected in the current loop

Speed Loop Kp
Proportional Gain of the Speed Loop

Speed Loop Tau I
Integral Time constant (in milliseconds) of the Speed Loop
Note: Internal $K_i = T_e / T_{auI}$ (With T_e is Sampling time)

Sub-Index	0x08
Description	Position Loop Kp
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	1.0
Sub-Index	0x09
Description	Position Loop Tau I
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	0
Sub-Index	0x0A
Description	Position Loop Kv
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	1.0
Sub-Index	0x0B
Description	Current Loop Feedback
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0x01
Sub-Index	0x0C
Description	Speed Loop Feedback
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0x01
Sub-Index	0x0D
Description	Position Loop Feedback
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0x01

Position Loop Kp
Proportional Gain of the Speed Loop

Position Loop Tau I
Integral Time constant (in milliseconds) of the Speed Loop
Note: Internal $K_i = T_e / \text{Tau}_i$ (With T_e is Sampling time)

Position Loop Kv
Theoretical Speed coefficient correction injected in the Speed loop

Feedback:
Indicate which Feedback coder is used

- Absolute coder
- 0x00: Smart Abs
 - 0x01: Resolver
 - 0x02: Biss
 - 0x03: Endat
 - 0x04: SSI
 - 0x05..0x0F: ..for future use

- Relatif coder
- 0x10: Auxiliary incremental feedback
 - 0x11..0x1F: For future use

!/\ Be careful. If Position Loop Feedback is a "MultiTurn" feedback, check MotorParameters.Polarity is set to 0. Because "Low Level Polarity" is not compatible with MultiTurn coder. Instead, use "High Level Polarity" 0x607E.

IV.4.8 0x2112 – Motor Parameters

Motors’s parameters. These values can be tuned independently (expert) or automatically written after Auto-Tuning method

Object description

Attribute	Value
Index	0x2112
Name	Motor Parameters
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x0B
Default Value	0x0B
Sub-Index	0x01
Description	Pole Number
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	6
Sub-Index	0x02
Description	Inverted Phase
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x03
Description	Speed Filter Fc
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	50.0
Sub-Index	0x04
Description	I2t Reference Time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2000
Sub-Index	0x05
Description	I2t Actual Value
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x06
Description	Max phase current mA
Entry Category	Mandatory
Access	ro
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	750
Sub-Index	0x07
Description	Max phase current Time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16 [0.. 5000]
Default Value	1000

Pole number

Define the number of motor pole

Inverted Phase

Set after an Auto-Tuning Electrical zero search procedure to 0xFFFF if motor phase inversion was detected

Speed Filter Fc

Speed calculation is done from the motor Electrical Angle derivation. A filter is applied from this derivation to have a correct speed. Here the Low pass filter cut-off frequency in Hz

I2t Reference Time

Integration time in millisecond used to detect an over power dissipation in the rotor (Used with Inominal and IMax : 0x6075, 0x6073)
For I2t, Imax is always limited to 200%. (Get 0x6073 Max current, if > 200%, get 200%)
Maximum value is 10000 (10s)

I2t Actual Value

Return the current I2t value in PerThousand. 1000 indicate I2t generate fault error...

Max phase current mA / Max phase current Time

On each current measure (100µs) if at least one current phase overPass the MaxPhaseCurrentmA during the MaxPhaseCurrentTime, then error E04 is generated.

- The MaxPhaseCurrentmA is given in mA and automatically defined according hardware

- The MaxPhaseCurrentTime is given in µs (Max is 5000 = 5ms)

Note: In Hardware variant Object, subIndex "Drive Maximal Phase current mA" same value

Sub-Index	0x08
Description	Polarity
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x09
Description	Nominal speed
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	3000
Sub-Index	0x0A
Description	Start Mode Of Operation
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Integer 8
Default Value	0
Sub-Index	0x0B
Description	HallSensorConnection
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0

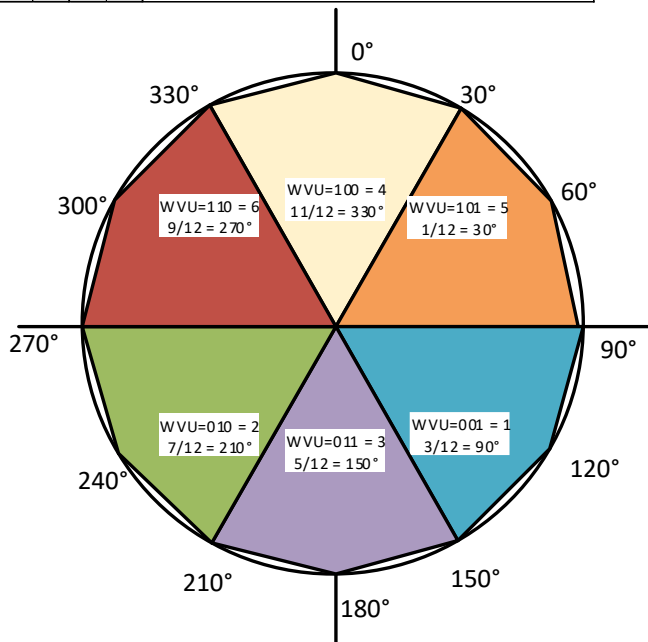
Polarity value
 Allow to choose the polarity of this Motor.
 0 = Normal polarity
 1 => inverted polarity

Nominal speed
 Just for indication, return the motor nominal speed in tr/min. This parameter is not used by the Drive

Start Mode Of Operation
 Define the ModeOfOperation object value (0x6060) taken on drive Power ON
 (0 = NoMode, -1 = GearBox Mode, -3 = Asynchronous velocity mode, 1 = Profile Position Mode...) (Refer to 0x6060 ModeOfOperation value)

Hall sensor connection
 Set after an Auto-Tuning Electrical zero search procedure.
 Allow to determine if there is a problem on the Hall effect configuration.
 The 8-MSB value is the Hall effect sensor code when the motor is on the electrical Zero.
 The 8-LSB is the first code seen when the motor moved in the positive way, after the Electrical zero code.
 In normal case, the code on electrical zero should be 4, and the following code should be 5.

8-MSB	8-LSB	Dec	Hex	Diagnostic
1	5	261	105	U <-> W
1	3	259	103	U <-> W + Motor phase inverted
2	3	515	203	V <-> W
2	6	518	206	V <-> W + Motor phase inverted
3	2	770	302	Hall sensor polarity inverted (NPN <-> PNP)
3	1	769	301	U <-> V + Hall sensor polarity inverted (NPN <-> PNP)
4	5	1029	405	Ok!
4	6	1030	406	U <-> V
5	4	1284	504	V <-> W + Hall sensor polarity inverted (NPN <-> PNP)
5	1	1281	501	V <-> W + Hall sensor polarity inverted (NPN <-> PNP) + Motor phase inverted
6	2	1538	602	U <-> W + Hall sensor polarity inverted (NPN <-> PNP)
6	4	1540	604	U <-> W + Hall sensor polarity inverted (NPN <-> PNP) + Motor phase inverted
0	0	0	0	Not hall effect configured



IV.4.9 0x2113 – Asynchronous Motor Parameters

Object description	
Attribute	Value
Index	0x2113
Name	Asynchronous Motor Parameters
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

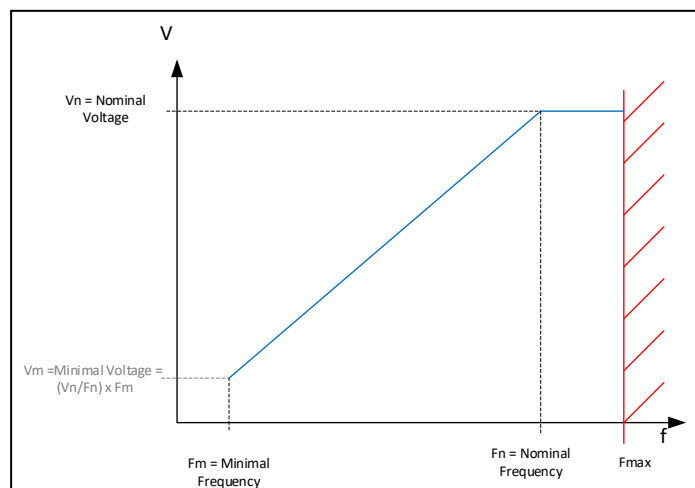
Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	Nominal Frequency
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	500
Sub-Index	0x02
Description	Minimal Frequency
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x03
Description	Maximal Frequency
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	600
Sub-Index	0x04
Description	Nominal Voltage
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	2300

Nominal Frequency
Indicate the nominal use frequency of the motor.
Unit is 1/10 Hz : [10.0Hz..400.0Hz]

Minimal Frequency
Indicate the minimal use frequency of the motor.
Unit is 1/10 Hz : [10.0Hz... Nominal Frequency]

Maximal Frequency
Indicate the maximal use frequency of the motor.
Unit is 1/10 Hz : [Nominal Frequency..400.0Hz]

Nominal Voltage
Indicate the nominal use voltage of the motor.
Unit is 1/10 V : [100.0V..480.0V]



IV.4.10 0x212x – Absolute Feedback

Absolute Feedback configuration:

0x2120: Tamagawa (SmartAbs)

0x2121: Resolver

0x2122: Biss

0x2123: EnDat

Values are taken internally only on Activated passed from FALSE to TRUE. After that, please restart the drive.

Object description	
Attribute	Value
Index	0x2120
Name	Feedback SmartAbs
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x07
Default Value	0x07
Sub-Index	0x01
Description	Activated
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x02
Description	Step Per Turn
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	131072
Sub-Index	0x03
Description	MultiTurn coder
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	1
Sub-Index	0x04
Description	Electrical Angle Shift
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	0.0
Sub-Index	0x05
Description	Polarity
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x06
Description	Raz MultiTurn value
Entry Category	Mandatory
Access	wo
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x07
Description	Raz monoTurn value
Entry Category	Mandatory
Access	Safety
PDO Mapping	None
Value Range	Unsigned16
Default Value	0

Activated:

Set to 1 if this feedback is present and used. Else set to 0

Step Per Turn

Define the number of step per turn of this coder

MultiTurn coder

Set to 1 to indicate if this coder has a multiTurn capability
write: Can write other value only if this feedback support MultiTurn

Electrical Angle Shift

Define the shift between the electrical zero angle and the mechanical zero angle. Can be set manually or after an Auto Tuning methode

Polarity value

Allow to choose the polarity of this coder.

0 = Normal polarity (Motor in same sens of coder)

1 => inverted polarity (Motor in reverse sens of coder)

Cette polarité est physique entre le capteur et le moteur. Elle peut servir à risque qu'un codeur indépendant est utilisé. Si ce codeur est maintenant placé face au moteur plutôt que de dos, cela permet d'inverser le sens du codeur sans modifier le sens des position/vitesse du système. Ne pas utiliser cette polarité pour inverser le sens de rotation du moteur. L'utiliser si on inverse physiquement le codeur par rapport au moteur.

Raz MultiTurn value

Write any value here allow to reset the Multi Turn position value (Available only if MultiTurn coder is 1)

Raz MonoTurn value

Write any value here allow to reset the Absolute 1 Turn position value.

This **MUST** be used **only** in factory for encoder calibration.

Access to this object is done via the Safety behavior.

=> Note: This way should not be used since Auto-Tuning Electrical Zero search can also automatically reset the monoturn Value on the Electrical Zero...

0x2124: SSI

Object description

Attribute	Value
Index	0x2124
Name	Auxiliary SSI
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x07
Default Value	0x07
Sub-Index	0x01
Description	Activated
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x02
Description	Step Per Turn
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	4096
Sub-Index	0x03
Description	MultiTurn coder
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x04
Description	Electrical Angle Shift
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	0.0
Sub-Index	0x05
Description	Polarity
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x06
Description	BusFrequencyKHz
Entry Category	Mandatory
Access	rw
PDO Mapping	None
Value Range	Unsigned16
Default Value	320
Sub-Index	0x07
Description	Gray code
Entry Category	Mandatory
Access	rw
PDO Mapping	None
Value Range	Unsigned16
Default Value	0

Activated:
Set to 1 if this feedback is present and used. Else set to 0

Step Per Turn
Define the number of step per turn of this coder

MultiTurn coder
Set to 0 indicate we use the feedback only with mono turn value.
Else indicate the number of bit used by the Feedback for the MultiTurn value.

Electrical Angle Shift
Define the shift between the electrical zero angle and the mechanical zero angle. Can be set manually or after an Auto Tuning methode

Polarity value
Allow to choose the polarity of this coder.
0 = Normal polarity (Motor in same sens of coder)
1 => inverted polarity (Motor in reverse sens of coder)
Cette polarite est physique entre le capteur et le moteur. Elle peut servir lorsque qu'un codeur independant est utilise. Si ce codeur est maintenant place face au moteur plutot que de dos, cela permet d'inverser le sens du codeur sans modifier le sens des positions/vitesse du systeme. Ne pas utiliser cette polarite pour inverser le sens de rotation du moteur. L'utiliser si on inverse physiquement le codeur par rapport au moteur.

Bus Frequency KHz
Frequency of the bus
Fmin >= (NBits + 1.5) / 50µs

Gray Code
If different to 0 this indicate code provided is in gray.

IV.4.11 0x213x - Relative sensor

Relative Feedback configuration:

0x2130: Incremental Auxiliary encoder

0x2131: Incremental Feedback encoder

Values are taken internally only on Activated passed from FALSE to TRUE. After that, please restart the drive.

Object description	
Attribute	Value
Index	0x2131
Name	Feedback Qep
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x06
Default Value	0x06
Sub-Index	0x01
Description	Activated
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x02
Description	Inc Per Turn
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	4096
Sub-Index	0x03
Description	Associated Absolute feedback
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0xFFFF
Sub-Index	0x04
Description	Electrical Angle Shift
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	0.0
Sub-Index	0x05
Description	Polarity
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x06
Description	Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x07
Description	Sensor less algorithm: RampeTime
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Real32
Default Value	1,258
Sub-Index	0x08
Description	Sensor less algorithm: Kp
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Real32
Default Value	5.0

Activated:

Set to 1 if this feedback is present and used. Else set to 0

Inc Per Turn

Define the number of increment per turn of this coder.

If the coder insicate 2500points/turn, you should enter 10000 increment per turn (x4)

Associated Absolute sensor

Indicate which absolute codeur should be used to determine the start absolute position on a turn

0 is associated with 0x2120 Object (SmartAbs)

1 is associated with 0x2121 Object (Resolver)

2 is associated with 0x2122 Object (Biss)

3 is associated with 0x2123 Object (Endat)

9 for associate with SensorLess Algorithm initial determination

0xFFFF for no associating (Start with position = 0)

0xFFFF for associate him with Hall effect captor (PNP positive logic) ; 0xFFFC: UWW; 0xFFFA: VWU; 0xFFFB: VUW

0xFFFD for associate him with Hall effect captor (NPN negative logic); 0xFFFB: UWW; 0xFFFD: VWU; 0xFFFE: VUW

Electrical Angle Shift

Define the shift between the electrical zero angle and the Top Z signal. Can be set manually or after an Auto Tuning methode

This is only used in case of associated Absolute Feedback is the Hall sensor (0xFFFF)

Polarity value

Allow to choose the polarity of this coder.

0 = Normal polarity (Motor in same sens of coder)

1 => inverted polarity (Motor in reverse sens of coder)

Cette polarité est physique entre le capteur et le moteur. Elle peut servir à risque qu'un codeur indépendant est utilisé. Si ce codeur est maintenant placé face au moteur plutôt que de dos, cela permet d'inverser le sens du codeur sans modifier le sens des positions/vitesse du système. Ne pas utiliser cette polarité pour inverser le sens de rotation du moteur. L'utiliser si on inverse physiquement le codeur par rapport au moteur.

Mode

0: Quadrature Count Mode (A, A/, B, B/, Z, Z/)

1: Quadrature Count Mode (A, A/, B, B/)

2: Pulse/Direction Mode (A, A/, Dir, Dir/)

3: Cw/Ccw

4: ICw/ICcw

For SensorLess algorithm only: RampeTime

Define the time of the Current rampe apply during the algorithm. The way is to have the smoother rampe when the motor will move.

The total time is divided into 3 phases (Low, Middle, Last)

Low take 64% of the total Time with current from 0 to 0,2 of motor rated current

Middle take 20% of the total time with current from 0,2 to 0,5 of motor rated Current

Last take 16% of the total time with current from 0,5 to 1,0 of motor rated current

For SensorLess algorithm only: Kp

When the current grow up, the position algorithm control the motor move to limit the motor rotation.

Kp control this loop.

IV.4.12 0x2140 – Master Feedback Parameters

Master feedback parameters. Indicate which coder feedback is used for the Master, and set Master motor parameters.

Object description

Attribute	Value
Index	0x2140
Name	Master Feedback Parameters
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x0F
Default Value	0x0F
Sub-Index	0x01
Description	Pole Number
Entry Category	Mandatory
Access	ro
PDO Mapping	none
Value Range	Unsigned16
Default Value	2
Sub-Index	0x02
Description	Speed Filter Fc
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Real32
Default Value	50.0
Sub-Index	0x03
Description	MasterFeedback
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned16
Default Value	0x10
Sub-Index	0x04
Description	GearRatioMotorRevolutions
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	1
Sub-Index	0x05
Description	GearRatioShaftRevolutions
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	1
Sub-Index	0x06
Description	FeedConstantFeed
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	10000
Sub-Index	0x07
Description	FeedConstantShaftRevolutions
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	1
Sub-Index	0x08
Description	UserDefinedUnitRatioPud
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	10000

Pole number

Define the number of motor pole

Speed Filter Fc

Speed calculation is done from the motor Electrical Angle derivation. A filter is applied from this derivation to have a correct speed. Here the Low pass filter cut-off frequency in Hz

MasterFeedback:

Indicate which Feedback coder is used to get the Master Position and speed.

- Absolute coder
- 0x00: Smart Abs
- 0x01: Resolver
- 0x02: Biss
- 0x03: Endat
- 0x04: SSI
- Relatif coder
- 0x10: Qep
- 0x11..0x1F: For future use

GearRatioMotorRevolutions/GearRatioShaftRevolutions:

Equivalent to object 0x6091 (GearRatio) for the Motor axis

FeedConstantFeed/FeedConstantShaftRevolutions:

Equivalent to object 0x6092 (FeedConstant) for the Motor axis

UserDefinedUnitRatioPud

Define the ratio applied to the Pud on the master.

Ex. If Feed and gear ratio is 1. The unit will be in motor Lap.

If UserDefinedUnitRatioPud = 10000, the Master position will be "10000" for a lap etc...

Sub-Index	0x09
Description	UserDefinedUnitRatioVud
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	1000
Sub-Index	0x0A
Description	UserDefinedUnitRatioAud
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned32
Default Value	1000
Sub-Index	0x0B
Description	PositionRangeLimitMin
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	signed32
Default Value	0
Sub-Index	0x0C
Description	PositionRangeLimitMax
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	signed32
Default Value	0
Sub-Index	0x0D
Description	Actual Position
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	signed32
Default Value	0
Sub-Index	0x0E
Description	Actual Velocity
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	signed32
Default Value	0
Sub-Index	0x0F
Description	Home Master Offset
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	signed32
Default Value	0
Sub-Index	0x10
Description	FilterType
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	No
Value Range	Unsigned16
Default Value	1

UserDefinedUnitRatioVud

Define the ratio applied to the Vud on the master.
 Ex. If Feed and gear ratio is 1. The unit will be in motor Lap/s.
 If UserDefinedUnitRatioVud = 1000, With Pud = 10000 the Master velocity will be "1000" for a lap/s etc...

UserDefinedUnitRatioAud

Define the ratio applied to the aud on the master.
 Ex. If Feed and gear ratio is 1. The unit will be in motor Lap/s.
 If UserDefinedUnitRatioAud = 1000, With Pud = 10000 the Master acceleration will be "1000" for a lap/s² etc...

Position Range limit Min/Max

Equivalent to object 0x607B (Position Range limit) for the Motor axis to apply a modulo to the Master position

Actual position

Return the Master feedback actual position (in Master P.u.d)

Actual Velocity

Return the Master feedback actual velocity (in Master V.u.d)

HomeMasterOffset

Same function as 0x607C (Home Offset) but for the Master axis

Filter Type

Select the filter applied to the Master:

- 0: no filtering: the synchronization is very fast but risk of blow if the ratio is high (for 1 master revolution, the slave makes several revolutions)
- 1: standard filtering (default)
- 2: Advanced filter 1: thanks to a low time constant and advanced filtering, the synchronization keeps a fairly fast response and decreases sharply blows (especially for high ratios)
- 3: Advanced filter 2: thanks to a high time constant and advanced filtering, the synchronization eliminates very strongly the blows but loses in precision (increases the response time)
- 4: Interpolation filter 1: Interpolation filtering for high ratios where master speed varies little.
- 5: Interpolation filter 2: Interpolation advanced filtering for high ratios where the master speed varies little, the synchronization eliminates very strongly the blows but loses in precision (increases the response time)

IV.4.13 0x2141 – CAN Master Position

(CAN VERSION only)

Object to exchange the Master position between a Master and a Slave

Can be used With Drive Basic Instruction or Specific mode using Master Synchro (Gearbox...)

Object description	
Attribute	Value
Index	0x2141
Name	Can Master Position
Object Code	Record
Data Type	Motor Parameters
Category	Mandatory if Drive CAN version

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x03
Default Value	0x03
Sub-Index	0x01
Description	Local TimeStamp
Entry Category	Mandatory if Drive CAN version
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x02
Description	Distant TimeStamp
Entry Category	Mandatory if Drive CAN version
Access	wo
PDO Mapping	Rx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x03
Description	DistanMasterPosition
Entry Category	Mandatory if Drive CAN version
Access	wo
PDO Mapping	Rx
Value Range	Unsigned32
Default Value	0

LocalTimeStamp

Return the current TimeStamp of the system (Incremented on each Main Process of 100µs)

Can be used by a distant slave to know the Time where get position (6064,0, 6062,0 or 2140,13) was sampling. The condition is This object gat by a PDO in the SAME PDO of the Get Position

DistantTimeStamp

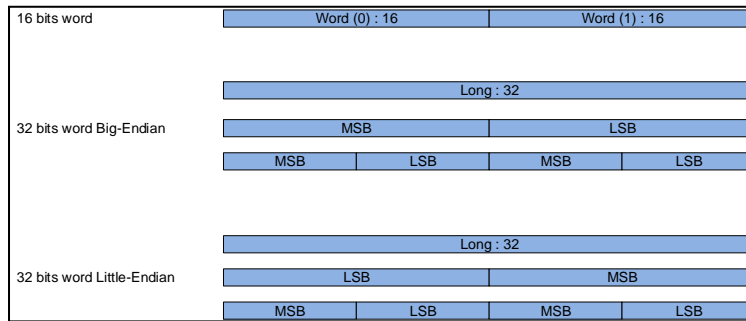
A distant Master can send it local TimeStamp on which the provided position was sampled.

DistanMasterPosition:

Current position of the Distant Master axis

IV.4.14 0x2200 – Gateway Com parameters

Configure Modbus Endianness and Raw base address to access in the whole Memory mapping of the DSP.



Object description

Attribute	Value
Index	0x2200
Name	Gateway COM parameters
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	RS232 Endianess
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	{0, 1} (unsigned16)
Default Value	0
Sub-Index	0x02
Description	Raw address
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	0
Sub-Index	0x03
Description	Float Accuracy
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	UNSIGNED16
Default Value	0
Sub-Index	0x04
Description	USB Minimum Inter Frame delay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	{0..1000}
Default Value	1
Sub-Index	0x05
Description	USB Maximum Inter Byte delay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	{1..1000}
Default Value	10
Sub-Index	0x06
Description	RS232 Minimum Inter Frame delay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	{0..1000}
Default Value	1
Sub-Index	0x07
Description	RS232 Maximum Inter Byte delay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	{1..1000}
Default Value	10
Sub-Index	0x08
Description	USB Life counter
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Unsigned 16
Default Value	0
Sub-Index	0x09
Description	RS232 Life counter
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Unsigned 16
Default Value	0

Modbus Endianness:

0: Little Endian
 1: Big Endian
 other value: Little Endian
 This parameter not apply on Modbus USB and ModBusTCP port 10502

Raw data:

On modbus request we can access to the modbus table (0x000..0x1000), but on address 0x2000 we can access to the FRAM and at 0x8000 (until xDFFF) we can access to the entire DSP memory mapping with a shifted base address given by "Raw address"

Float Accuracy:

If = 0, this function is not activated.
 If >0, all object Read or written via the modBus which is a Real (float) is converted to a "Fixed point value"
 Then this, value specify the number of decimal for the fixed point value.
 If n = 4, value of 10001 means 1.0001 (1/10ⁿ)

USB Minimum Inter Frame delay:

Define the minimum inter frame delay when data are transmitted via USB link. (in milliseconds)

USB Maximum Inter Byte delay

Define the maximum delay between 2 successive bytes of a Modbus frame. After this delay, all incomplete frame are discard (In milliseconds)

RS232 Minimum Inter Frame delay:

Define the minimum inter frame delay when data are transmitted via RS232 link. (In millisecond)
 Each device must wait this delay before start a new frame.
 Value is define by ModBus RTU as 3,5Char.
 Then Min value is 3,64ms for 9600bauds, 1,82ms for 19200 etc... For Cpu Load, min value is 2ms.
 Taken value = MAX (0x2200.6, 2ms, RoundUpperMillisecond(35/BaudRate))
 Set to 0 will ensure to be configured to the best time.

RS232 Maximum Inter Byte delay

Define the maximum delay between 2 successive bytes of a Modbus frame.(In millisecond) After this delay, Frame is considered as ended.All incomplete frame are discard
 Value is define by ModBus RTU as 1,5Char.
 Then Min value is 1,5ms for 9600bauds, 780µs for 19200 etc... For Cpu Load, min value is 1ms.
 Taken value = MAX (0x2200.7, 1ms, RoundUpperMillisecond(15/BaudRate))
 Set to 0 will ensure to be configured to the best time.

USB Life counter:

This counter is incremented on each Read/Write modbus request

RS232 Life counter:

This counter is incremented on each Read/Write modbus request

IV.4.15 0x2201 – CAN Speed

Configure the baud rate on the CAN bus

Object description	
Attribute	Value
Index	0x2201
Name	CAN Speed (Only for CAN version)
Object Code	VAR
Data Type	Unsigned32
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	CAN Speed
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	{10000, 20000, 50000, 125000, 250000, 500000, 800000, 1000000}
Default Value	500000

CAN Speed:
CAN baud rate in bps, Value is taken only on Power ON.
So if value is modified, VAR must be restarted to taken the new value.

IV.4.16 0x2202 – COM parameters

Configure the RS232 communication

Object description	
Attribute	Value
Index	0x2202
Name	RS232 COM parameters
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	RS232 Speed
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	57200
Value Range	0x02
Description	RS232 Configuration
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned8
Default Value	NONE

RS232 Speed:
Baud rate speed of the RS232 link in bps/s

RS232 Configuration:
Nb Data: Bits 0..2: {4..7} = { 5bits..8 bits}
Parity: Bits 5, 6: {0..3} = {0, 1, 2, 3} = {None, Odd, None, Even}
Nb Stop Bits: Bit7: {0, 1} = {1 Bit Stop, 2 Bits Stop}

IV.4.17 0x2205 – Ethernet parameters

Configure the Ethernet parameters (For ProfNet and Ethernet/IP device only)

If Enable DHCP = FALSE AND IP Address = 0.0.0.0, the configuration is managed by the master itself. It can configure it, reset it by the network and its configured value will be remanent to the power Off/On.

Else, the Drive force the configured IP address on Power On. The master can change it after Init time, but will not be remanent after PowerOff/On. Configured value will be restored.

To pass the ProfNet Conformance certification test, this parameter must be disable (DHCP = FALSE, IP Address = 0.0.0.0)

Object description

Attribute	Value
Index	0x2205
Name	Ethernet Parameters (Only for ENET version)
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	1x
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	Enable DHCP
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	FALSE
Value Range	0x02
Description	IP Address
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	192.168.1.1
Value Range	0x03
Description	SubNetMask
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	255.255.255.0
Value Range	0x04
Description	Gateway
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	0.0.0.0

Enable DHCP:
If TRUE, enable DHCP function
Change is taken after drive restart

IP Address:
Configure the IP Address of the device.
Format is coded like Following:
192.168.1.1->0xC0 A8 01 01
!! Specific value. If last Byte is 255 (0xFF) this is not 255 taken, but SMD nodeID (Set by DIPs)
Change is taken after drive restart

SubNet Mask
Configure the SubNet mask of the device.
Format is coded like Following:
255.255.255.0->0xFF FF FF 00
Change is taken after drive restart

Gateway:
Configure the Gateway of the device.
Format is coded like Following:
192.168.1.1->0xC0 A8 01 01
Change is taken after drive restart

IV.4.18 0x2206 – SDO Client parameters

Define the parameters needed for the SDO Client (CANOpen protocol)

Object description

Attribute	Value
Index	0x2206
Name	SDO Client parameters
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	TimeOut
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	3
Value Range	0x02
Description	Retry
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned32
Default Value	0

TimeOut:

indicate the timeOut to receive a response from the Server to the Client request. Time is in ms [1..65535].
If 0 is configured, 1ms is taken

Retry:

Number of try to send request when timeOut expired before abort them.
0 = No Retry.
...

IV.4.19 0x2300 – Homing

Homing Manufacturer additional parameters

Object description

Attribute	Value
Index	0x2300
Name	Homing
Object Code	Record
Data Type	Homing Manufacturer additional parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	INominal
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned32
Default Value	300
Sub-Index	0x02
Description	Time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	300
Sub-Index	0x03
Description	IMax
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	1100
Sub-Index	0x04
Description	ReleaseDistance
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned32
Default Value	500

INominal, Time, IMax:

These parameters are use when no switch is used to detect Left/Right home position. The detection method is done by detecting blocked motor => I2t

When $I^2t > (I_{Nominal} * I_{Max})^2 * Time$ then we considere motor blocked.

INominal is given in mA

Time is given in milliseconds

IMax is given in Per thousand of INominal

Release Distance

Distance in position user defined unit parse in reverse sense after current limit detection (method -1, -2, -17, -18)

IV.4.20 0x2400 - Digital inputs value

To get all digital input value (In addition to object 0x60FD)

Object description

Attribute	Value
Index	0x2400
Name	Digital Inputs Value
Object Code	Record
Data Type	Input value
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	PhysicalValue
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned32
Default Value	-
Sub-Index	0x02
Description	DebouncedValue
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned32
Default Value	-
Sub-Index	0x03
Description	CapturedPosition1
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	signed32
Default Value	-
Sub-Index	0x04
Description	CapturedPosition2
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	signed32
Default Value	-

PhysicalValue:

Return the physical value of the input
 bit 0: Input 0 (Enable)
 bit 1: Input 1 (FC+ switch)
 bit 2: Input 2 (FC- switch)
 bit 3: Input 3 : (Home switch)
 bit 4: Input 4 : (Capture 1 switch)
 bit 5: Input 5 : (Capture 2 switch)
 bit 6: Input STOA (Safety)
 bit 7: Input STOB (Safety)
 bit 8 to 17: Extension board I1..I10

PhysicalValue (Specific version Only):

Return the physical value of the input
 bit 0: ETOR 1
 bit 1: FC+ switch
 bit 2: FC- switch
 bit 3: ETOR 2

DebouncedValue:

Return the physical value of the input after the debounce algorithm
 bit 0: Input 0 (Enable) bit 8 to 17: Extension board I1..I10
 bit 1: Input 1 (FC+)

...
 Bit 7 (**No Debounce on STO Input!**)

CapturedPosition1:

Position of the axis when Rising edge on input capture 1 occurs (only if special fuction for this input was activated)
 Position is given un Position Used Defined (P.u.d)
 Mirror of object 0x60BA (Touch Probe 1 Positive Edge)

CapturedPosition2:

Position of the axis when Rising edge on input capture 1 occurs (only if special fuction for this input was activated)
 Position is given un Position Used Defined (P.u.d)
 Mirror of object 0x60BC (Touch Probe 2 Positive Edge)

IV.4.21 0x2401 – Digital Inputs Control

To configure some parameters on each input

Object description	
Attribute	Value
Index	0x2401
Name	Digital Inputs Control
Object Code	Record
Data Type	Input value
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x0C
Default Value	0x0C
Sub-Index	0x01
Description	Inverted
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	0x0000
Sub-Index	0x02
Description	SpecialFunctionEnable
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	0x0000
Sub-Index	0x03
Description	DebounceActivated
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	0x3F
Sub-Index	0x04
Description	SlowInputDebounceTime
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	10000
Sub-Index	0x05
Description	FastInputDebounceTime
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	1000
Sub-Index	0x06
Description	InterlockSpecialFunctionSet
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0x0000
Sub-Index	0x07
Description	CaptureWindow1
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	{NO, INSIDE, OUTSIDE}
Default Value	NO
Sub-Index	0x08
Description	WindowPosMin1
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	signed32
Default Value	0

...

Inverted:

If set to 1, the μ C hardware input is inverted
 bit 0: Input 0 (Enable) bit 8 to 17: Extension board I1 to I10
 bit 1: Input 1 (FC+ switch) bit 9 to 16: Extension board I1 to I10
 bit 2: Input 2 (FC- switch) bit 17: Extension board I1 to I10
 ...

SpecialFunctionEnable:

If set to 1, the input special function is activated
 bit 0: Input 0 (Enable input) : Allowing to validated or allowing the EnableOperation : **In this mode, the debounce is internally used for this signal**
 bit 1: Input 1 (FC+ switch): If switch is activated, trig a QuickStop
 bit 2: Input 2 (FC- switch): If switch is activated, trig a QuickStop
 bit 3: Input 3 (Home switch): No special function
 bit 4: Input 4 : (Capture 1 switch) : Enable Capture of Current Position (DS402 Object 0x6088 Msut also be enabled)
 bit 5: Input 5 : (Capture 2 switch) : Enable Capture of Current Position (DS402 Object 0x6088 Msut also be enabled)
For Input Capture, use of DriveBasic instruction will automatically enable/Disable the function. This object is not used.
(No SpecialFunctionEnable on STO Input!)

DebounceActivated:

If set to 1, The input value taken internally is the debounced value
 bit 0: Input 0 (Enable)
 bit 1: Input 1 (FC+)
 ...
 bit 6 **(No Debounce on STO Input!)**, bit 8 to 17: Extension board I1 to I10

SlowInputDebounceTime

Debounce time in μ s used for the "Slow input" when Debounce is activated (This time is 100 μ s step).
 0 -> 199 : 100 μ s; 200 -> 299: 200 μ s; 300 -> 399: 300 μ s etc... Slow Input are:
 bit 0: Input 0 (Enable input)
 bit 1: Input 1 (FC+ switch)
 bit 2: Input 2 (FC- switch)
 bit 3: Input 3 (Home switch)
 bit 8 to 17: Extension board I1 to I10

FastInputDebounceTime

Debounce time in μ s used for the "Fast input" when Debounce is activated (This time is 100 μ s step).
 0 -> 199 : 100 μ s; 200 -> 299: 200 μ s; 300 -> 399: 300 μ s etc... Fast Input are:
 bit 4: Input 4 : (Capture 1 switch)
 bit 5: Input 5 : (Capture 2 switch)

Note: The position captured is always the current position on the last rising (Falling) edge of the input if the High (Low) level stay stable during this Debounce time

InterlockSpecialFunctionSet:

When special function is set for the input "Enable", this object allowing to indicate the special function behavior:
 0 : Validating Mode (Can pass from/to Disable/Enable operation without communication order)
 1 : Allowing Mode (Must be activated to allow transition to EnableOperation when order is asked by the communication)

CaptureWindow1

Define if the TouchProbe 1 must be triggered if position according the current position and the configured window
 0 = NO => No window, Touch Probe is always triggered
 1 = INSIDE => TouchProbe is captured only if the position is inside the defined window
 2 = OUTSIDE => TouchProbe is captured only if the position is outside the defined window
 Any other value => INSIDE
 Note: DriveBasic instruction can change internally the taken value

WindowPosMin1:

Min window definition in p.u.d
 Note: DriveBasic instruction can change internally the taken value

Sub-Index	0x09
Description	WindowPosMax1
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	signed32
Default Value	0
Sub-Index	0x0A
Description	CaptureWindow2
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	{NO, INSIDE, OUTSIDE}
Default Value	NO
Sub-Index	0x0B
Description	WindowPosMin2
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	signed32
Default Value	0
Sub-Index	0x0C
Description	WindowPosMax2
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	signed32
Default Value	0
Sub-Index	0x0D
Description	Serial Extention board IO detected
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	unsigned 16
Default Value	0

WindowPosMax1:

Max window definition in p.u.d
Note: DriveBasic instruction can change internally the taken value

CaptureWindow2

Define if the TouchProbe 2 must be triggered if position according the current position and the configured window
 0 = NO => No window, Touch Probe is always triggered
 1 = INSIDE => TouchProbe is captured only if the position is inside the defined window
 2 = OUTSIDE => TouchProbe is captured only if the position is outside the defined window
 Any other value => INSIDE
Note: DriveBasic instruction can change internally the taken value

WindowPosMin2:

Min window definition in p.u.d
Note: DriveBasic instruction can change internally the taken value

WindowPosMax2:

Max window definition in p.u.d
Note: DriveBasic instruction can change internally the taken value

Serial Extention board IO detected:

If = 1, then the serial extention IO board was detected. If = 0, board was not detected

IV.4.22 0x2402 – Digital Outputs Control

To configure some parameters on each output

Object description

Attribute	Value
Index	0x2402
Name	Digital Outputs Control
Object Code	Record
Data Type	Input value
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x04
Default Value	0x04
Sub-Index	0x01
Description	Inverted
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	0x0000
Sub-Index	0x02
Description	SpecialFunctionEnable
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	0x0001 0001
Sub-Index	0x03
Description	BrakeLockingTime
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	50000
Sub-Index	0x04
Description	BrakeReleaseTime
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned32
Default Value	50000
Sub-Index	0x05
Description	BeforeBrakeReleaseTime
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Unsigned32
Default Value	1000

Inverted:

If set to 1, the μ C hardware output is inverted
 bit 0: Output TOR Q2 (/!\, Not taken if special function Brake enabled /!\)
 bit 16: Output TOR Q1
 Specific version Only: Bit 17 to 22 for TOR S1 to S6
 Extension board : bit 23 to 30 : S3 to S10

SpecialFunctionEnable:

If set to 1, the Output special function is activated
 bit 0: Output TOR Q2 (Break Output) : Manage the brake commande
 bit 16: Output TOR Q1 Var Ok Output) : Output activated when the device is operational (Not in the "Fault state" or "Fault Reaction active state")

BrakeLockingTime:

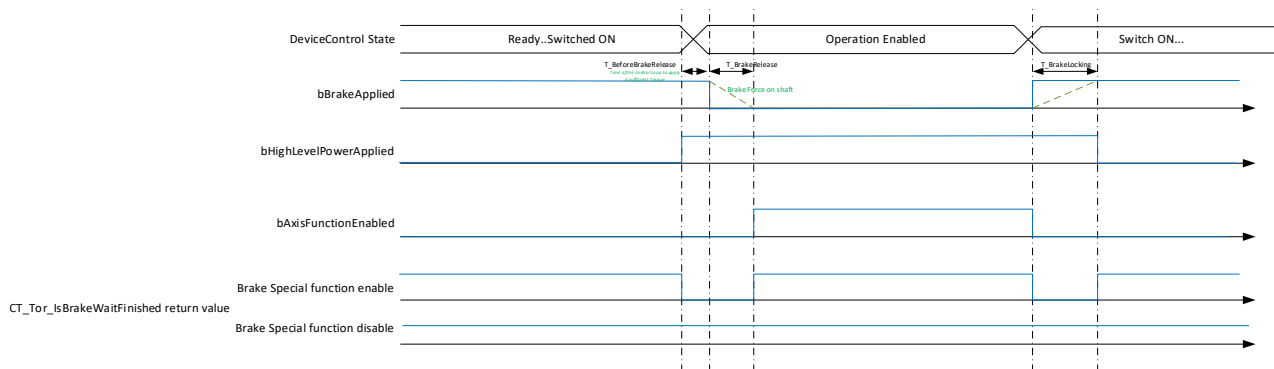
This is the time in μ s taken by the brake to lock the axis after activation (When special function is activated)

BrakeReleaseTime:

This is the time in μ s taken by the brake to unlock the axis after deactivation (When special function is activated)

Before Brake Release Time:

This is the time in μ s between Control Loop activation and Brake release command. (To let the time to the control loop to apply a sufficient torque)



IV.4.23 0x2403 – Analog Inputs

To configure and get the analogue input. (Only on a specific version of SMD)

Object description	
Attribute	Value
Index	0x2403
Name	Analog inputs
Object Code	Record
Data Type	Input value
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x03
Default Value	0x03
Sub-Index	0x01
Description	Analog Input
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Real
Default Value	0x0000
Sub-Index	0x02
Description	Filter Tau
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	50
Sub-Index	0x03
Description	Filtered Analog Value
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Real
Default Value	0x0000
Sub-Index	0x04
Description	Offset
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	signed16
Default Value	0
Sub-Index	0x05
Description	Gain
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	10

Analog value:
Return the current analog value in volt (Only if option available)
[0.0 .. 10.5V]

Filter Tau
Define the time constant of the filter in milliseconds

Filtered Analog Value:
return the same as object 0x2403.01 but with a filter.

Offset:
Apply an offset value on the returned analog value
[-10000 ... +10000] = [-10.000V ... +10.000V]

Gain:
AFTER Offset applied Multiply input by thus amplification
[1 ... 10000] = [0.01 ... 100.00]

Read AnalogValue = (Analog Input + Offset) x Gain

IV.4.24 0x2404 – 7 Segments display

Return the current status of the 7 segments display

Object description	
Attribute	Value
Index	0x2404
Name	Display 7 segments
Object Code	Record
Data Type	unsigned 8
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	7 Segments displayed value
Entry Category	Mandatory
Access	ro
PDO Mapping	No
Value Range	Unsigned 8
Default Value	None

7 Segment display:
Bit 0 correspond to segment G
Bit 1 correspond to segment F
Bit 2 correspond to segment E
Bit 3 correspond to segment D
Bit 4 correspond to segment C
Bit 5 correspond to segment A
Bit 6 correspond to segment B

IV.4.25 0x2405 – Analog Output

To set the analog output (Only on a specific version of SMD)

Object description	
Attribute	Value
Index	0x2405
Name	Analog output
Object Code	Variable
Data Type	parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Analog Output
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	Real
Default Value	0

Analog Output:
Set the analog value in volt (Only if option available)
[0.0.. 10.0V]

IV.4.26 0x2500 – DCBus Control

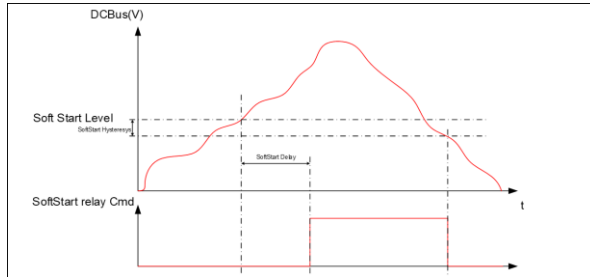
Supervision and protection of the DCBus voltage

Object description

Attribute	Value
Index	0x2500
Name	DCBus control
Object Code	Record
Data Type	
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x0F
Default Value	0x0F
Sub-Index	0x01
Description	SoftStartLevel
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2000 (200,0V)
Sub-Index	0x02
Description	Reserved
Entry Category	Mandatory
Access	
PDO Mapping	
Value Range	
Default Value	
Sub-Index	0x03
Description	SoftStartDelay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	20
Sub-Index	0x04
Description	SoftStartEnableDelay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	100
Sub-Index	0x05
Description	UnderVoltageLevel
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2000 (200,0V)



Soft Start Level:
Define the minimum DCBus level to activate the SoftStart relay.
Unit is 0,1V
Minimum Value : SoftStart Hysteresys + 1V

SoftStartDelay:
Delay in millisecond between DCBus reach SoftStartLevel and SoftStart relay command.

SoftStartEnableDelay:
Delay in millisecond between Relay is switch ON and Enable High Level Power allowed (SwitcONDisable to ReadyToSwitcON transition).

Under Voltage Level:
DCBus voltage level under which the "Under Voltage error" will be triggered. If set to 0, the monitoring is disabled.
Note: The under voltage is monitoring only when device is enable (HighLevelPower applied)
Unit is 0,1V

Sub-Index	0x06
Description	UnderVoltageDelay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	100
Sub-Index	0x07
Description	OverVoltageLevel
Entry Category	Mandatory
Access	ro
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	3900 (390,0V)
Sub-Index	0x08
Description	OverVoltageDelay
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2
Sub-Index	0x09
Description	RBrakeLevel
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	According SMD version
Sub-Index	0x0A
Description	RBrakeHysteresis
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	70 (7,0V)
Sub-Index	0x0B
Description	RBrakeTon
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	40
Sub-Index	0x0C
Description	RBrakePeriod
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2700
Sub-Index	0x0D
Description	DCBus Measure methode
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x0E
Description	DCBus Value
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x0F
Description	Brake Heating
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x10
Description	Rbrake catalog number
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	Visible String(50)
Default Value	0
Sub-Index	0x11
Description	Rbrake value
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0
Sub-Index	0x12
Description	Rbrake selected voltage
Entry Category	Mandatory
Access	rw
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	0

Under Voltage Delay

The DCBus voltage must be under the level during this time (given in milliseconds) to trig the "under voltage error".
Min = 130V

Over Voltage Level:

DCBus voltage level over which the "Over Voltage error" will be triggered. If set to 0, the monitoring is disabled.
Unit is 0,1V
Max 390V

READ ONLY: This value is fixed to 390V to protect the Hardware component (Capacity of 400V)

Over Voltage Delay:

The DCBus voltage must be over the level during this time (given in milliseconds) to trig the "Over voltage error".
Range is 0 to 10ms.

RBrake Level:

Level to command the RBrake to apply it on the DCBus
Unit is 0,1V
Set to 0 disable Rbrake behavior.

Note: This value is volatile. On each start, default value is taken.

RBrake Hysteresis:

Hysteresis in 0,1V
Maximum is 20,0V

RBrake Ton:

Define the maximum command time (in ms) on the RBrakePeriod where the RBrake can be applied before trig an Error.

RBrake Period:

Define the RBrakePeriod (in ms) in which the Ton is evaluated.

DCBus Measure methode:

Return the method used to measure the DCBus:
0 = Sigma delta (isolated)
1 = Shunt + ADC

DCBus Value:

Return the non filtered DCBus value in 0,1V (375V => 3750)

Brake Heating:

Return the current Brake heating in per thousand

Rbrake catalog number:

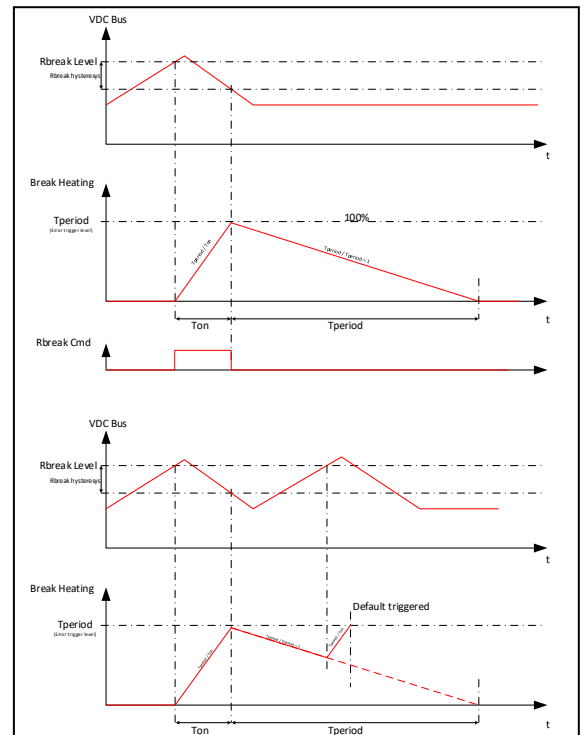
Allow user to indicate the Rbrake catalog number.
This is just for information, not used by the drive.

RBrake Value:

User must enter the Rbrake ohmique value plugged to the drive. (In ohm)
This allow the drive to check if this value can be supported by itself. If not, a configuration error will be generated. (E51, 0x7112. Nbit1 = 1)

Rbrake Selected voltage:

User must indicate the considered Drive input voltage (Vac) used to compute the Rbrake Ton and Tperiod parameter.
0: 24VDC, 1: 48VDC, 2: 230 VAC Mono, 3: 400 VAC Tri, 4: 480 VAC Tri
This allow drive to check if it is ok in case of master configuration done considering an SMD230, then file transferred to an SMD400.
If voltage error, a configuration error will be generated (E51, 0x7112. Nbit0 = 1)



IV.4.27 0x2501 – Temperature control

To configure some parameters to supervising the temperature of IGBT and motor.

Object description

Attribute	Value
Index	0x2501
Name	Temperature control
Object Code	Record
Data Type	
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x06
Default Value	0x06
Sub-Index	0x01
Description	MaxIGBTTemp
Entry Category	Mandatory
Access	ro
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	1000 (100,0°C)
Sub-Index	0x02
Description	MaxIGBTTempTime
Entry Category	Mandatory
Access	ro
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2000 (2s)
Sub-Index	0x03
Description	MaxMotorTempType
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	1
Sub-Index	0x04
Description	MaxMotorTemp
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	150
Sub-Index	0x05
Description	MaxMotorTempTime
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Rx/Tx
Value Range	Unsigned16
Default Value	2000 (2s)
Sub-Index	0x06
Description	IGBTTemp
Entry Category	Mandatory
Access	ro
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	

Max IGBT Temp:

Define the maximum admissible IGBT temperature. If overpass this threshold, error is generated and High power is switch-off
Unit is 0,1°C
(for 90°C, value is 900)

Max IGBT Temp Time:

The IGBT temperature must be over the defined threshold (MAXIGBTTemp) during this time before trig an error
Unit is millisecond

MaxMotorTempType:

Define the type of sensor used to control the motor temperature:

- 0 : NTC
- 1 : PTC
- 2 : CNO (Contact normalement ouvert)
- 3 : CNF (Contact normalement Fermé)
- 4 : No sensor

MaxMotorTemp:

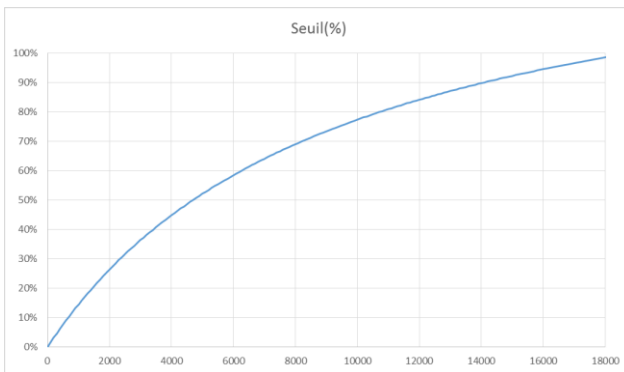
Define the Threshold of motor temperature which generate an error (used In case of NTC or PTC).
Ex. We want trig an error if motor is above 90°C. We have a NTC which have a value of 2000 ohms at 90°. According the above curve, we must set this parameter to 260 (26%)
Exact formula is % = $1,5 \times (RCapteur / (RCapteur + 9400))$

Max Motor Temp Time:

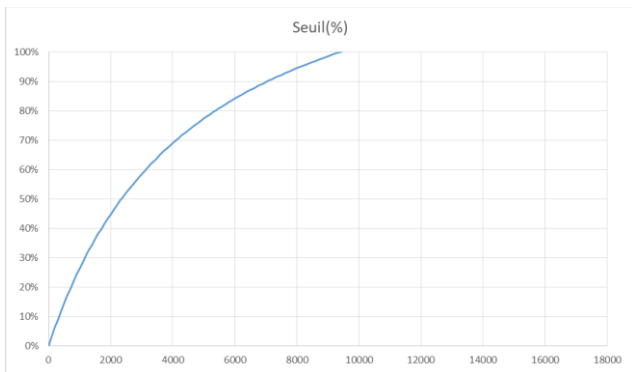
The Motor temperature must be over the defined threshold (MAXMotorTemp) during this time before trig an error
Unit is millisecond

IGBT Temp:

Return the current IGBT temperature
Unit is 0,1°C
(for 90°C, value is 900)



SMD with connection CM+ AND CM-



SMD with connection CM+ only

IV.4.28 0x2700 – Filtered Current Actual Value

Return the same as object 0x6078 (Current Actual Value) but pass by a filter. Also return current in mA.

Object description

Attribute	Value
Index	0x2700
Name	Filtered Current Actual Value
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	Filter Tau
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	50
Sub-Index	0x02
Description	Filtered Current Actual Value
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Integer16
Default Value	NONE
Sub-Index	0x03
Description	Current Actual Value mA
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Integer32
Default Value	NONE
Sub-Index	0x04
Description	Filtered Current Actual Value mA
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Integer32
Default Value	NONE

Filter Tau
Define the time constant of the filter in milliseconds

Filtered Current Actual Value:
return the same as object 0x6078 but with a filter. The current correspond to the current in the motor and the value is given in per thousand of rated current.

Current Actual Value mA:
return the same as object 0x6078 but directly in mA.

Filtered Current Actual Value mA:
Same as SubIndex 2 but in mA

IV.4.29 0x2701 – Filtered Velocity Actual Value

Return the same as object 0x606C (Velocity Actual Value) but pass by a filter

Object description

Attribute	Value
Index	0x2701
Name	Filtered Velocity Actual Value
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x02
Default Value	0x02
Sub-Index	0x01
Description	Filter Tau
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	unsigned16
Default Value	50
Sub-Index	0x02
Description	Filtered Velocity Actual Value
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	Integer32
Default Value	NONE

Filter Tau

Define the time constant of the filter in milliseconds

Filtered Velocity Actual Value:

return the same as object 0x606C but with a filter. The current correspond to the Velocity of the motor and the value is given user-defined velocity units

IV.4.30 0x2702 – Target position

Return the same as object 0x607A (Target position). This is a mirror object and can be used when Master does not accept to have same object mapped in many PDO.

IV.4.31 0x2703 – Profile Velocity

Return the same as object 0x6081 (Profile Velocity). This is a mirror object and can be used when Master does not accept to have same object mapped in many PDO.

IV.4.32 0x2704 – Gearbox Mode Parameters

Allow to configure the Gearbox Ratio and acceleration used in the Gearbox Mode profile.

Attribute	Value
Index	0x2704
Name	GearBox mode parameters
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	0x03
Default Value	0x03
Sub-Index	0x01
Description	Distance Slave
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Integer32
Default Value	1
Sub-Index	0x02
Description	Distance Master
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Integer32
Default Value	1
Sub-Index	0x03
Description	Distance Acceleration
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Integer32
Default Value	0
Sub-Index	0x04
Description	Reversible
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	Tx
Value Range	Unsigned16
Default Value	0

Distance Slave

Numerator of the GearBox Ratio in P.u.d (Slave)

Distance Master

Denominator of the GearBox Ratio in P.u.d (Master)

Distance Acceleration

Distance to apply the GearBox Ratio ("Clutch") in P.u.d (Master)

Reversible

If TRUE, GearBox is reversible.

IV.4.33 0x2705 – Torque Limit Parameter

Set a limitation of the Torque. Given in Permille of Max Current (0x6073)

Object description

Attribute	Value
Index	0x2705
Name	Torque Limit
Object Code	Variable
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	TorqueLimit
Entry Category	Mandatory
Access	rw
PDO Mapping	None
Value Range	Unsigned16
Default Value	1000

Torque limit

Allow to limit the torque of Current Loop.

Value is given in PerMil of MaxCurrent (0x6073).

=> 0x6073 is given in PerMile of Nominal Current (0x6075)

IV.4.34 0x2706 – Motor Angle

Give the current motor Angle {0... 1,0}

Object description

Attribute	Value
Index	0x2706
Name	Motor Angle
Object Code	Variable
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Motor Angle
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	float32
Default Value	None

IV.4.35 0x2707 – Target Velocity

Return the same as object 0x60FF (Target Velocity. This is a mirror object and can be used when Master does not accept to have same object mapped in many PDO).

Object description

Attribute	Value
Index	0x2707
Name	Target Velocity
Object Code	Variable
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Tagret Velocity (Refer to the DS402 object 0x60FF)
Entry Category	Mandatory
Access	rw
PDO Mapping	1x
Value Range	unsigned integer32
Default Value	-

IV.4.36 0x2709: Asynchronous velocity mode

Allowing to drive the Asynchronous specific mode:

Attribute	Value
Index	0x2709
Name	Asynchronous Velocity Mode
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	None
Value Range	0x0C
Default Value	0x0C
Sub-Index	0x01
Description	Control Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	2
Sub-Index	0x02
Description	Stop Mode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x03
Description	Velocity Input
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0
Sub-Index	0x04
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x05
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x06
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x07
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x08
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100

Control Mode

- 0: TOR input. {E1, E2} = {M/A, Direction}
- 1: TOR input. {E1, E2} = {ClockWise, AntiClockWise}
- 2: Stopped
- 3: ON ClockWise (At startup time, if into this value, return to Stopped (2))
- 4: ON AntiClockWise (At startup time, if into this value, return to Stopped (2))

Stop Mode

- 0: Deceleration rampe
- 1: Freewheel
- 2: According Input TOR E3. 0 = Deceleration Rampe, 1 = Freewheel

Velocity input

Indicate the Source velocity when Input TOR {E4, E5, E6} = {0,0,0}
 0x00: Analog Input 0: 0V => 0% = FMin. 10V => 100% = FMax
 0x10: By communication bus object 0x60FF TargetVelocity. Unit is in 0,1%
 0x11: By communication bus object 0x60FF TargetVelocity. Unit is in 0,1Hz

Preselection velocity Table Value 1

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {0,0,1}

Preselection velocity Table Value 2

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {0,1,0}

Preselection velocity Table Value 3

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {0,1,1}

Preselection velocity Table Value 4

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,0,0}

Preselection velocity Table Value 5

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,0,1}

Sub-Index	0x09
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x0A
Description	Preselection velocity Table Value 1
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	100
Sub-Index	0x0B
Description	Acceleration time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	5000
Sub-Index	0x0C
Description	Deceleration time
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	5000

Preselection velocity Table Value 6

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,1,0}

Preselection velocity Table Value 7

Applied velocity (in 0.1HZ) when Input TOR {E4, E5, E6} = {1,1,1}

Acceleration time

Allow to configure the acceleration rampe. Value is the time given in 1/10s to pass from 0 to Nominal Speed.

Deceleration time

Allow to configure the deceleration rampe. Value is the time given in 1/10s to pass from Nominal Speed to 0.

IV.4.37 0x2800 – Hardware variant

Allow to know the hardware specific variant

Object description

Attribute	Value
Index	0x2800
Name	Hardware variant information
Object Code	Record
Data Type	parameters
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Highest sub-index supported
Entry Category	Mandatory
Access	c
PDO Mapping	Tx
Value Range	16
Default Value	16
Sub-Index	0x01
Description	Supervision mode
Entry Category	Mandatory
Access	wo
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x02
Description	Model
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x03
Description	Voltage
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x04
Description	BusType
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x05
Description	Intelligent Version
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x06
Description	Current
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x07
Description	Available Feedback
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x08
Description	EMC Filter
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA

Supervision mode

If write 0xA5 in this object, SMD pass to the supervision mode. (BusType pass to "NONE")

If write 0x5A in this object, SMD return to the normal mode. (BusType pass to original value (NONE/CAN/ECAT))

Model

Return the drive model:

0 : SMD

1 : x

Voltage

Return the drive voltage:

0: 24VDC

1: 48VDC

2: 230 VAC Mono

3: 400 VAC Tri

4: 480 VAC Tri

BusType:

0 = EtherCAT

1 = CAN

2 = None (Stepper)

Note: This value can be read to 2 (NONE) if Modbus is in "Supervision mode"

Intelligent version:

Return 1 if the SMD Intelligent mode is available

Current

Return the drive Current Option

0: 1A

1: 2A

2: 5A

3: 10A 6: 40A

4: 20A

5: 30A

Available Feedback:

indicate which feedback is present on the hardware:

Bit 0: Serial encoder Tamagawa

Bit 1: EnDat 2.2

Bit 2: Resolver

Bit 3: Incremental + Hall

Bit 4: Incremental Only for DPL Master position Feedback

Bit 5 : EnDat, Bit 6 : Biss

EMC Filter:

Return 1 if EMC Filter is implemented on the board

Sub-Index	0x09
Description	Safety
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x0A
Description	NodeID
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x0B
Description	DisplayNode
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x0C
Description	Rshunt
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	real
Default Value	NA
Sub-Index	0x0D
Description	Current Methode
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x0E
Description	Drive Nominal Current
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned32
Default Value	NA

Safety:
Return 1 if Safety input are implemented on the board

NodeID:
Return the NodeID number configured by the DIPS

Display Node:
Return 1 if node is displayed on startup
Node is determined by Dip.
It is displayed when use a Bus which need it.

R Shunt value:
Return the value of the Rshunt use to measure phase current.
AMC1304 give 90% of the full scale when input is 250mV, So Max Current measurable = 0.25 / RShunt = 12.5A if Rshunt value is 0,02ohm

Current methode:
Return the hardware methode used to measure the motor phase current:
0x000: Sigma Delta
0x0100: Shunt + ADC

Drive Nominal Current:
Indicate the Maximal value on this drive for Nominal motor current (0x6075) (in mA)

Sub-Index	0x0F
Description	Drive Maximal Current
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned32
Default Value	NA
Sub-Index	0x10
Description	Drive Maximal phase current
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned32
Default Value	NA
Sub-Index	0x11
Description	AnalogInputActivated
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x12
Description	TOROutputActivated
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x13
Description	SoftStartActivated
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x14
Description	IGBTTemperatureManaged
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x15
Description	CoilTemperatureManaged
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x16
Description	ExtensionBoard
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x17
Description	Revision
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x18*
Description	ETor1Localisation
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned16
Default Value	NA
Sub-Index	0x19*
Description	DCBus coefficient
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	float32
Default Value	NA
Sub-Index	0x1A
Description	Serial Number
Entry Category	Mandatory
Access	ro
PDO Mapping	None
Value Range	unsigned64
Default Value	NA

* Used for internal behavior only

Drive Maximal Current:

Indicate the maximal value on this drive for Maximal motor current (0x6073) (in mA)

Drive Maximal phase current:

Indicate the maximal value on this drive for Maximal current (in mA) on each motor phase (Generate Error 04)
Note: In object "Motor Parameters" subindex "Max phase current mA" is the same value.

Analog Input Activated:

Some specific SMD version has analogic input.
This bit field variable indicate if Analog input are present or not.
Bit 0 : Analog Input 0

TOROutputActivated:

Some specific SMD version has TOR Output.
This bit field variable indicate if TOR Output are present or not.
Bit 0 : TOR Output 0
...
Bit 5: TOR Output 5

Soft Start Activated:

Some SMD version has SoftStart or not. This object indicate if it is managed or Not.
0 = Not Managed.
1 = Managed

IGBT Temperature Managed:

Some SMD version has IGBT temperature sensor or not. This object indicate if it is managed or Not.
0 = Not Managed.
1 = Managed

Coil Temperature Managed:

Indicate if coil temperature is managed or Not
This protection is present since HW version 000
0 = Not Managed.
1 = Managed

Extension Board:

indicate the presence or not of optional extension board. If 1, board is present:
Bit 0 : Extension board IO: 8 Output, 10 Input

Revision:

Indicate the revision of the SMD

ETor 1 Localisation:

If true, indicate the Etor 1 is routed to the GPIO133 instead of the GPIO24, now used for Endat signal
Note: This indication is FALSE for the following condition:
- Specific SMD version
- SMD230
This indication is TRUE for all other: SMD230A, SMD400...

DCBus coefficient:

Indicate the internal coefficient apply on DCBus measure related to the initial normal hardware.
The normal coefficient is 1.0. On hardware with DCBus Higher than 500V, coefficient must be different.

Serial Number

Device serial number. Format:
YY MMn nnn xxx
YY: OF year {1-99} for {2001.. 2099}
MM: OF month {1-12}
nnn: OF Number {1-999}
xxxx: OF Serial {1-9999}

IV.4.38 0x2803 – Pre-Defined Error Fifo: Time Stamp

This object works exactly like the standard object 0x1003. But we get the Time Stamp value instead of the Error identifier value

IV.4.39 0x2806 – Restore default behaviour

Configure the behaviour on 0x1011.1 object.

Object description

Attribute	Value
Index	0x2806
Name	Restore default behavior
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory

Entry description

Attribute	Value
Sub-Index	0x00
Description	Behavior
Entry Category	Mandatory
Access	rw
PDO Mapping	None
Value Range	Unsigned16
Default Value	0

If 0, the 0x1011.1 object will restore the default value on the SMD.
If <0, the 0x1011.1 object will not have any effect.

IV.4.40 0x2900 - Get Description file

Allow to get the description file (Eds, Xml...) over the Serial bus

Object description	
Attribute	Value
Index	0x2900
Name	Description File
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	Get Description file
Entry Category	Mandatory
Access	wo
PDO Mapping	1x
Value Range	Unsigned16
Default Value	0

Write value other than 0 in this object will trig the sending of the complete description file over the USB bus (In ascii format)
Eds for CAN, Xml fom EtherCAT...

IV.4.41 0x2902 – ECAT Mode

Allow to configure the EtherCAT mode use. Either normal COE DS402 compatible mode or SERAD MPC EtherCAT compatible.

Object description	
Attribute	Value
Index	0x2902
Name	ECAT Mode
Object Code	VAR
Data Type	Unsigned16
Category	Mandatory

Entry description	
Attribute	Value
Sub-Index	0x00
Description	EcatMode
Entry Category	Mandatory
Access	rw-NV
PDO Mapping	None
Value Range	Unsigned16
Default Value	0

ECAT Mode:
0: COE DS402
1: MPC master

V. DS402 Error Code (EMCY frame)

Error code (MS) [SMD ErrorCode]	Meaning
2110 _h	Short circuit/earth leakage (input)
2120 _h	Earth leakage (input)
2121 _h	Earth leakage phase L1
2122 _h	Earth leakage phase L2
2123 _h	Earth leakage phase L3
2130 _h	Short circuit (input)
2131 _h	Short circuit phases L1-L2
2132 _h	Short circuit phases L2-L3
2133 _h	Short circuit phases L3-L1
2211 _h	Internal current no.1
2212 _h	Internal current no.2
2213 _h	Over-current in ramp function
2214 _h	Over-current in the sequence
2220 _h	Continuous over current (Hardware TRIP detection)
2221 _h	Continuous over current no.1
2222 _h	Continuous over current no.2
2230 _h	Short circuit/earth leakage (device internal)
2240 _h	Earth leakage (device internal)
2250 _h	Short circuit (device internal)
2310 _h (00 _h) [E05]	Continuous over current: Trip: Over current on DCBus.
2310 _h (01 _h) [E05]	Continuous over current: Source not identified.
2311 _h	Continuous over current no.1
2312 _h	Continuous over current no.2
2320 _h	Short circuit/earth leakage (motor-side)
2330 _h	Earth leakage (motor-side)
2331 _h	Earth leakage phase U
2332 _h	Earth leakage phase V
2333 _h	Earth leakage phase W
2340 _h [E04]	Short circuit (motor-side): Current on at least one phase higher than supported current
2341 _h	Short circuit phases U-V

2342 _h	Earth leakage phase V-W
2343 _h	Earth leakage phase W-U
2350 _h [E03]	Load level fault (I^2t , thermal state)
2351 _h	Load level warning (I^2t , thermal state)
3110 _h	Mains over-voltage
3111 _h	Mains over-voltage phase L1
3112 _h	Mains over-voltage phase L2
3113 _h	Mains over-voltage phase L3
3120 _h	Mains under-voltage
3121 _h	Mains under-voltage phase L1
3122 _h	Mains under-voltage phase L2
3123 _h	Mains under-voltage phase L3
3130 _h	Phase failure
3131 _h	Phase failure L1
3132 _h	Phase failure L2
3133 _h	Phase failure L3
3134 _h	Phase sequence
3140 _h	Mains frequency
3141 _h	Mains frequency too great
3142 _h	Mains frequency too small
3210 _h [E01]	DC link over-voltage
3211 _h	Over-voltage no. 1
3212 _h	Over voltage no. 2
3220 _h [E02]	DC link under-voltage
3221 _h [A03]	Under-voltage no. 1 (SoftStart voltage not reach on "Operation enable" asked)
3222 _h	Under-voltage no. 2
3230 _h	Load error
3310 _h	Output over-voltage
3311 _h	Output over-voltage phase U
3312 _h	Output over-voltage phase V
3313 _h	Output over-voltage phase W
3320 _h	Armature circuit
3321 _h	Armature circuit interrupted

3330 _h	Field circuit
3331 _h	Field circuit interrupted
4110 _h	Excess ambient temperature
4120 _h	Too low ambient temperature
4130 _h	Temperature supply air
4140 _h	Temperature air outlet
4210 _h [E07]	Excess temperature device (Motor temperature)
4220 _h	Too low temperature device
4300 _h	Temperature drive
4310 _h [E06]	Excess temperature drive (IGBT junction or Coil temperature)
4320 _h	Too low temperature drive
4400 _h	Temperature supply
4410 _h [E09]	Excess temperature supply (Coil temperature)
4420 _h	Too low temperature supply
5100 _h	Supply
5110 _h	Supply low voltage
5111 _h	U1 = supply ±15V
5112 _h [E17]	U2 = supply +24 V
5113 _h	U3 = supply +5 V
5114 _h [E28]	U4 = manufacturer-specific (Tamagawa / EnDat 5V power supply default)
5115 _h	U5 = manufacturer-specific
5116 _h	U6 = manufacturer-specific
5117 _h	U7 = manufacturer-specific
5118 _h	U8 = manufacturer-specific
5119 _h	U9 = manufacturer-specific
5120 _h	Supply intermediate circuit
5200 _h	Control
5210 _h	Measurement circuit
5220 _h	Computing circuit
5300 _h	Operating unit
5400 _h	Power section
5410 _h	Output stages
5414 _h [A04]	SAFETY input 0
5415 _h [A05]	SAFETY input 1

5420 _h	Chopper
5430 _h	Input stages
5440 _h	Contacts
5441 _h	Contact 1 = manufacturer-specific
5442 _h	Contact 2 = manufacturer-specific
5443 _h	Contact 3 = manufacturer-specific
5444 _h	Contact 4 = manufacturer-specific
5445 _h	Contact 5 = manufacturer-specific
5450 _h	Fuses
5451 _h	S1 = I1
5452 _h	S2 = I2
5453 _h	S3 = I3
5454 _h	S4 = manufacturer-specific
5455 _h	S5 = manufacturer-specific
5456 _h	S6 = manufacturer-specific
5457 _h	S7 = manufacturer-specific
5458 _h	S8 = manufacturer-specific
5459 _h	S9 = manufacturer-specific
5500 _h	Hardware memory
5510 _h	RAM
5520 _h	ROM/EPROM
5530 _h	FLASH (external flash access out of range)
5540 _h [H01]	FRAM (external FRam detection failed)
5550 _h [H02]	FLASH (external flash detection failed)
5560 _h [H03]	FLASH (Write CRC failed)
6010 _h [E25]	Software reset (watchdog)
6301 _h to 630F _h	Data record no. 1 to no. 15
6310 _h (01 _h) [A01]	Loss of parameters (External FRAM init: All MS parameters restored due to FRAM CRC failed on Version read)
6310 _h (02 _h) [A01]	Loss of parameters (External FRAM init: All MS parameters restored due to FRAM Version different to the SW version)
6310 _h (03 _h) [A01]	Loss of parameters (External FRAM init: At least one parameter is restored due to bad CRC)
6310 _h (04 _h) [A01]	Read Drive Basic variables or Timestamp information fail. Make 3 attempts.
6320 _h	Parameter error

7100 _h	Power
7110 _h	Brake chopper
7111 _h	Failure brake chopper
7112 _h (XX _h) [E51]	Over current brake chopper (configuration error Bit0: Configuration error on RBRake selected voltage Bit1: Configuration error on RBRake value
7113 _h [E51]	Protective circuit brake chopper (RBrake timeout)
7120 _h	Motor
7121 _h	Motor blocked
7122 _h	Motor error or commutation malfunction.
7123 _h	Motor tilted
7200 _h	Measurement circuit
7300 _h [E29]	Sensor
7301 _h	Tacho fault
7302 _h	Tacho wrong polarity
7303 _h [E16]	Resolver 1 fault (DOS error = Degradation Of signal)
7304 _h (00 _h) [E08]	Resolver 2 fault (LOS/PLL = Loss of signal): Magnitude too low
7304 _h (01 _h) [E08]	Resolver 2 fault (LOS/PLL = Loss of signal): Magnitude too high
7305 _h (XX _h) [E24]	Incremental sensor 1 fault (XX _h : Tamagawa communication error. See 0x2001.1)
7306 _h (XX _h) [A02]	Incremental sensor 2 fault (XX _h : Tamagawa battery alarm. See 0x2001.2)
7307 _h (XX _h) [E24]	Incremental sensor 3 fault (XX _h : see MSB = 0x2001.3, LSB = 0x02001.4)
7308 _h (XX _h) [E26]	EnDat / Biss fault 0x01: Biss communication error. 0x02: Biss CRC error 0x03: EnDat Clock init phase error 0x04: EnDat: Init Phase: ReceiveReset Request Timeout. 0x05: EnDat: Init Phase: SelectMemory Request Timeout. 0x06: EnDat: Init Phase: SelectMemory Request bad CRC. 0x07: EnDat: Init Phase: Data Request Timeout. 0x08: EnDat: Init Phase: Data Request bad CRC. 0x09: EnDat: Init Phase: Compensation Delay Timeout. 0x0A: EnDat: Init Phase: Compensation Delay bad CRC. 0x0B: EnDat: Run Phase: communication down. 0x0C: EnDat: Run Phase: Bad received CRC. 0x0D: SSI communication error
7309 _h (XX _h) [E27]	Incremental/Hall sensor fault 0x01: Feedback 0x02: Auxiliary This error occurs if inconsistency detected between Hall sensors and Incremental position. Then Check wire and sensor integrity 0x03: Sensor less algorithm leads to an oscillation, not stabilization. Modify sensor less parameters.

7310 _h	Speed
7320 _h	Position
7400 _h	Computation circuit
7500 _h	Communication
7510 _h	Serial interface no. 1
7520 _h	Serial interface no. 2
7600 _h	Data storage (external)
8100 _h [E20]	COM: State changed
8101 _h [I02]	COM: ECAT AL Status error
8110 _h	CAN: Overrun
8120 _h	CAN: Passive
8130 _h [E23]	CAN: Life guard
8140 _h [E23]	CAN: Bus Off
8210 _h	PDO not processed due to length error
8220 _h	PDO length exceeded
8230 _h	DAM MPDO not processed, destination object not available
8240 _h	Unexpected SYNC data length
8250 _h	RPDO timeout
8150 _h	CAN: RxPdo timeout
8300 _h	Torque control
8311 _h	Excess torque
8312 _h	Difficult start up
8313 _h	Standstill torque
8321 _h	Insufficient torque
8331 _h	Torque fault
8400 _h [E15]	Velocity speed controller
8500 _h	Position controller
8600 _h	Positioning controller
8611 _h [E12]	Following error
8612 _h [E30]	Reference limit
8700 _h	Sync controller
8800 _h	Winding controller
8900 _h	Process data monitoring
8A00 _h	Control

F001 _h	Deceleration
F002 _h	Sub-synchronous run
F003 _h	Stroke operation
F004 _h	Control
FF00 _h (10 _h)	Bad asked transition: CSP Mode, Ask Slow down ramp.
FF00 _h (20 _h) [I01]	Bad asked transition: CSP Mode, Ask Slow down ramp.
FF01 _h [H04]	Impossible to communicate with ET1100 via SPI
FF02 _h (02 _h)	Impossible to Read Eeprom of ESC (I ² C) (For EtherCAT version): Read was failed
FF02 _h (03 _h)	Impossible to Write Eeprom of ESC (I ² C) (For EtherCAT version): Write was failed
FF02 _h (10 _h) [H05]	Impossible to Read Eeprom of ESC (I ² C) (For EtherCAT version): Eeprom loaded signal not received under 2ms.
FF03 _h [H06]	Copy from OS μ C flash to external flash, but CRC was bad in External Flash
FF04 _h [E11]	Error in Drive Basic management (Refer to DB management error to know the task and Crash code)
FF05 _h [H07]	Case where signature in μ C is empty. Wait manufacture flash signature
FF06 _h [H08]	Case where signature in μ C is corrupted (bad CRC). Wait manufacture flash signature
FF07 _h [H09]	Case where signature in μ C different to Ext. Flash signature. This case is forbidden. Wait manufacture flash signature
FF08 _h (XX _h) [H10]	Internal system error: XX _h give indication on the source of allocation (Not erasable error) Contact manufacturer
FF09 _h (XX _h) [H11]	Communication board incompatible (n=0) HMS module configured protocol error (n=1) Software version does not support the Communication board (n=2)
FF0A _h [H12]	HMS module Hw interrupt signal fail
FF0B _h [E10]	Software internal error, contact manufacturer.
FF0C _h [E21]	With Serad MPC only: occurs when Axis on asked whereas Input 1 on Validation mode is not set
FF0D _h [H13]	Case where CPU board is not compatible with specific feedback (Biss, EnDat, SSI)
FF0D _h (0xaabb)[H14]	Simultaneous internal resources access. Contact manufacturer with complete error code 0xaabbFF0D
FF0F _h (01 _h) [E14]	All 3 Drive Basic variable read attempts failed on init phase. All Drive Basic variables have been reset to 0.
FF0F _h (02 _h) [E14]	All 3 Drive Basic variable write attempts failed.

VI. Revision

R1823	Original version
R1837	Add error code 82xxh
R1840	Add Motor Angle object (0x2706) Add Bit 15 in StatusWord (Safety information)
R1841	Update 2401 object (Touch Probe option)
R1842	Update Digital Input Control Add Modbus RTU service 0x06 Add 0x2707 object (mirror of 0x60FF object: Target Velocity) Update 0x2200 object description (RS232 timing) Add Touch Probe Objects
R1843	Update 0x6502 object (add Manufacturer specific) Update 0x6060 object (add Manufacturer specific) Add 0x2140.15 object (Home Master Offset) Add Homing Master mode Update 0x6007 Object: AbortConnectionOption code: Add specific manufacturer code Homing adds method 37
R1847	Update 0x2110 Object description (Autotuning) Update 0x2140 object (Master) on Ratio P.u.d, V.u.d, Aud. Update 0x6086 object. Motion Profile Type Jerk-Limited removed Add Gearbox mode
R1850	Update 0x6007 definition table Add STO inputs on object 0x60FD and 0x2400, 0x2401
R1902	Add 0x2205 Object: Ethernet parameters Add Infinite move possibility in PP mode
R1903	Update object 0x2140: Add Filter Type Add Object 0x2206: SDO Client parameters Rx/Tx PDO reduced from 10 to 8 (Object 0x140x, 0x160x, 0x180x, 0x1A0x)
R1905	Add 0x2141 Object Can Master Position Add Ethernet Configuration on Communication chapter
R1912	Feedback QEP (0x2130) add Sensorless Initial absolute position
R1914	DCBus Control 0x2500 update subindex 8, 9, 10
R1919	Add chapter III.1.4 Safety
R1921	Update Enable condition on Object 0x607B and 0x607D 0x2704 object: Remove AutoStart information (ModeOfOperation is now saved in NVMemory) 0x2403 object: Add Offset / Gain functionality on Analog input voltage
R1924	0x2902, Add ECTA mode object 0x2205 Add precision on the configuration
R1927	0x2130 Add parameter for Initial position algorithm
R1939	Update object information (default value) Object list: 2000, 2110, 2111, 2112, 212x, 213x, 2140, 2202, 2206, 2300, 2401, 2402, 2500, 2501, 2000 Update Error list (Add E26)
R1940	Update 0x60FD, 0x60FE, 0x2400, 0x2401, 0x2402 to add extension board TOR IO.. Add 0x2131 object
R1946	Add RxPdo Transmission type 0xFE
R1950	Add Error E27
R2002	Object 2402 updated to take new extension board S3 to S10 output TOR Add object 0x2405 (Analog Output)
R2026	Add Modbus TCP, Add 0x2002 Object
R2038	Add H14 Error description, Add A01.4 and A01.5 Warning description
R2046	Object 0x2131 updated (Hall combination), update 0x1011 object and add 0x2086 object Object 0x2500 updated (RBrake configuration), E51 updated
R2101	Add SSI Feedback error message
R2105	E27 (7309) add manufacturer specific code 3
R2109	Add asynchronous motor mode
R2110	Homing method detailed