STF-EtherCAT User Manual

APPLIED MOTION PRODUCTS, INC.

Contents

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EtherCAT STF User Manual

Introduction to EtherCAT

EtherCAT (Ethernet for Control Automation Technology) is a real-time Industrial Ethernet technology originally developed by Beckhoff Automation. The main focus during the development of EtherCAT was on short cycle times (≤ 100 µs), low jitter for accurate synchronization (≤ 1 µs) and low hardware costs.

The EtherCAT master sends a telegram that passes through each node. Each EtherCAT slave device reads the data addressed to it "on the fly", and inserts its data in the frame as the frame is moving downstream. The frame is delayed only by hardware propagation delay times. The last node in a segment (or branch) detects an open port and sends the message back to the master using Ethernet technology's full duplex feature.

Line, tree, star, or daisy-chain: EtherCAT supports almost all of topologies. Up to 65,535 devices can be connected to EtherCAT, so network expansion is virtually unlimited.

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

Commonly Used Acronyms

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

Protocol

EtherCAT embeds its payload in a standard Ethernet frame. The frame is identified with the Identifier (0x88A4) in the EtherType field. During startup, the master device configures and maps the process data on the slave devices. The EtherCAT frame contains one or more datagrams. The datagram header indicates what type of access the master device would like to execute:

      -Read, write, read-write

      -Access to a specific slave device through direct addressing, or access to multiple slave devices through logical addressing

Logical Addressing

Logical addressing is used for the cyclical exchange of process data. Each datagram addresses a specific part of the process image in the EtherCAT segment, for which 4 GBytes of address space is available. During network startup, each slave device is assigned one or more addresses in this global address space. If multiple slave devices are assigned addresses in the same area, they can all be addressed with a single datagram. Since the datagrams completely contain all the data access related information, the master device can decide when and which data to access. For example, the master device can use short cycle times to refresh data on the drives, while using a longer cycle time to sample the I/O; a fixed process data structure is not necessary.

In addition to cyclical data, further datagrams can be used for asynchronous or event driven communication. Besides the logical addressing, the master device can also address a slave in two ways:

Auto Increment Addressing

With Auto increment addressing, the master device addresses a slave via its position in the network. This method is used during network boot-up to determine the network topology and compare it to the planned topology.

Fixed Node Addressing

After checking the network configuration, the master device can assign each node a configured node address and communicate with the node via this fixed address. This enables targeted access to devices, even when the network topology is changed during operation.

EtherCAT STF User Manual

EtherCAT Frame Structure

In EtherCAT, the data between the master and the slaves is transmitted in Ethernet frames. An EtherCAT Ethernet frame consists of one or several EtherCAT datagrams, each addressing individual devices and/or memory areas. The EtherCAT frame structure is pictured in the following figure. Each EtherCAT datagram consists of a datagram header, the data area and a working counter (WKC), which is incremented by all EtherCAT nodes that are addressed by the datagram and have exchanged associated data.

Ethernet Header (14 bytes)			EtherCAT Data		FSC
Destination	Source	EtherType (88A4h)	EtherCAT Header	EtherCAT Datagrams	FSC
6 bytes	6 bytes	2 bytes	2 bytes	44 ~ 1498 bytes	4 bytes

EtherCAT Datagrams			
1st EtherCAT Datagram	2nd EtherCAT Datagram	...	nth EtherCAT Datagram

EtherCAT Datagram		
Datagram Header	Data	WKC
10 bytes	max. 1486 bytes	2 bytes

FSC: Frame Check Sequence
WKC: Working Counter

EtherCAT State Machine

Both the master and the slaves have a state machine with the states shown below. After boot the slaves are in INIT state, and then it's up to the master to request state transitions. The standardized EtherCAT state machine is defined in the following figure. The bootstrap state is not supported.
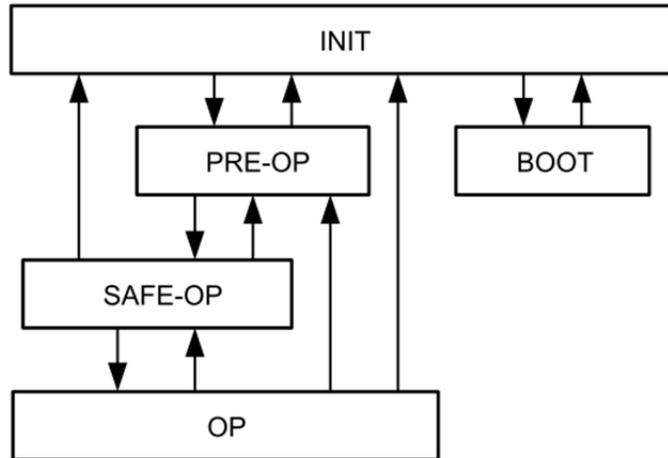
INIT: initialization
PRE-OP: pre-operational
SAFE-OP: safe-operational
OP: operational
BOOT: bootstrap

State	SDO	RPDO	TPDO	Description
INIT	×	×	×	State after device initialization. No communication on the Application Layer.
PRE-OP	√	×	×	After initialization of communication, device enters into this state. SDO is available at this state.
SAFE-OP	√	×	√	SDO and TPDO are available at this state.
OP	√	√	√	All of the SDO and PDO are available at this state. Drive fully operational.
BOOT	×	×	×	Not used.

EtherCAT STF User Manual

EtherCAT Status Indicator LED

The LEDs are used for indicating status of EtherCAT. There are two Link / Activity LEDs and two status LEDs (RUN and ERR).
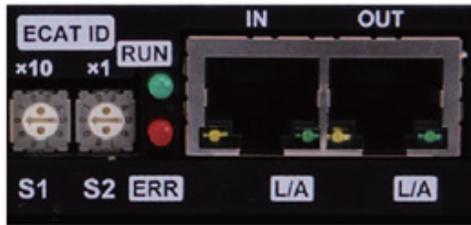
STF05/10-EC
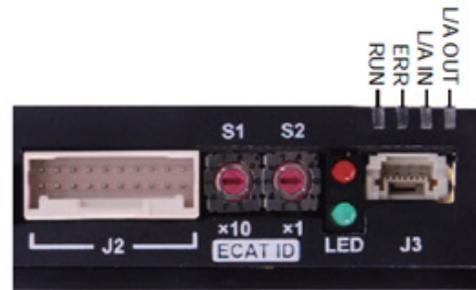
STF03/06-EC

LED indicator descriptions:

LED	Color	Status	Description
Link / Activity	Green	OFF	no Ethernet connection
		ON	Ethernet is connected
		Flickering	activity on line
RUN	Green	OFF	initialization state
		Blinking	pre-operational state
		Single Flash	safe-operational state
		ON	operational state
ERR	Red	OFF	no error
		Blinking	general error
		Single Flash	sync error
		Double Flash	watch dog error

Notes:
Flickering: Rapid flashing with a period of approx. 50ms (10 Hz)
Blinking: Flashing with equal on and off periods of 200ms (2.5Hz)
Single Flash: Repeating ON for 200ms and OFF for 1s
Double Flash: Two flashes with a period of 200ms followed by 1s OFF period

CANopen over EtherCAT

Applied Motion Products EtherCAT drives support CANopen over EtherCAT (CoE) which is the application layer communication protocol. CiA 402 drive profile is supported. The CoE device architecture is as below:
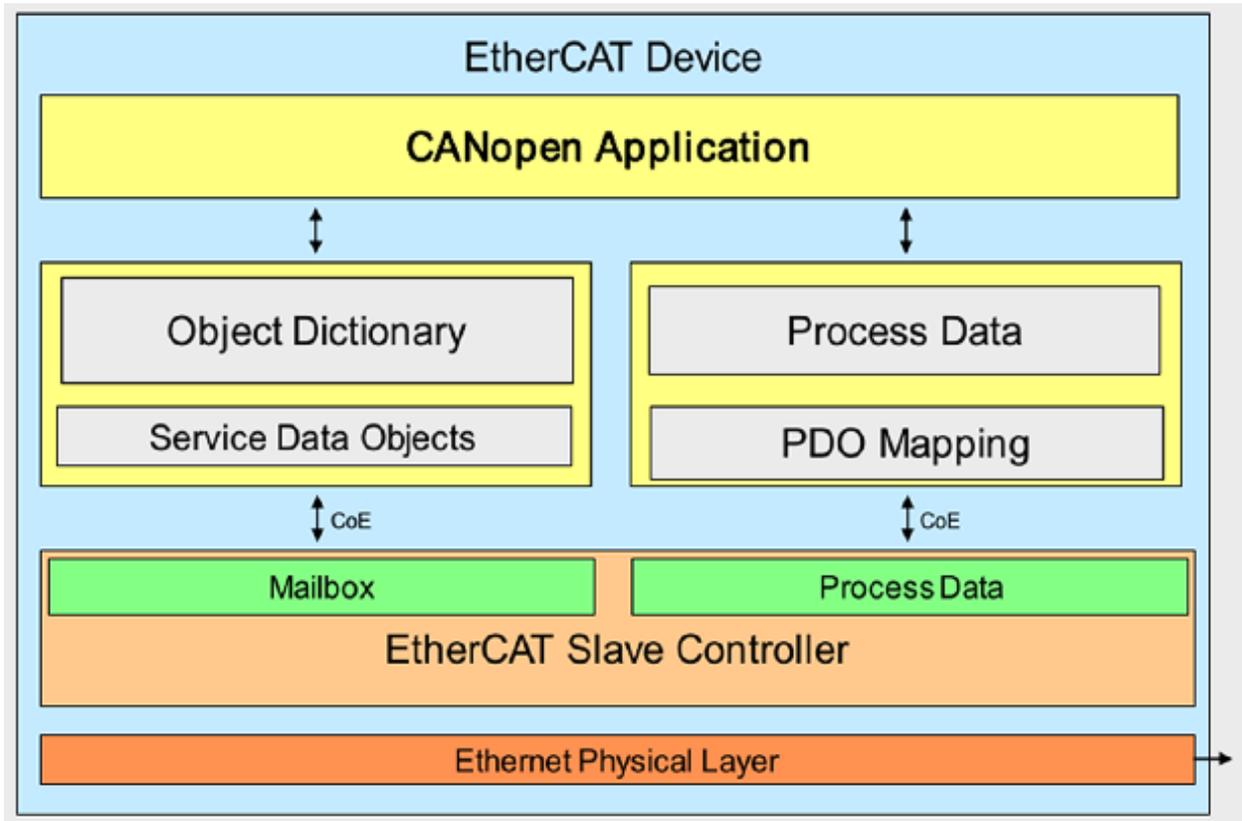
Following message types are used:

SDO (Service Data Object): SDO is used for acyclic data transmission. This communication can be used in PRE-OP, Safe-OP and OP state.

PDO (Process Data Object): PDO is used for cyclic data transmission. Data that will be transmitted or received is defined by PDO mapping.

EMCY (Emergency Object): EMCY is used for error report when a fault has occurred in the drive.

Synchronization

The EtherCAT solution for synchronizing nodes is based on distributed clocks (DC). The calibration of the clocks in the nodes is completely hardware-based. The time from the first DC slave device is cyclically distributed to all other devices in the system. With this mechanism, the slave device clocks can be precisely adjusted to this reference clock. The resulting jitter in the system is significantly less than 1µs.

Since the time sent from the reference clock arrives at the slave devices slightly delayed, this propagation delay must be measured and compensated for each slave device in order to ensure synchronicity and simultaneousness. This delay is measured during network startup or, if desired, even continuously during operation, ensuring that the clocks are simultaneous to within much less than 1µs of each other.

Applied Motion Products EtherCAT drives provide three synchronization modes:

Free Run
Slave's application is not synchronized to EtherCAT Master. Master and slave have an individual independent cycle.

SM Event
Slave's application is synchronized to SM Event.

DC SYNC Event
Slave's application is synchronized to SYNC Event.

The **synchronization cycle** that STF EtherCAT drive can support are: **500µs**, **1ms**, **2ms** and **4ms**.

EtherCAT Slave Information

Every EtherCAT device is delivered with an EtherCAT Slave Information (ESI) file in XML format. It describes the identity and all features of the device. The XML files for Applied Motion Products EtherCAT drive can be downloaded from Applied Motion Products website.

CiA402 Drive Profile

Operation Modes

STF EtherCAT drive supports following operation modes (0x6060):
- Profile Position (PP)
- Profile Velocity (PV)
- Cyclic Synchronous Position (CSP)
- Homing (HM)
- Q Program (Applied Motion Products specific mode)

Profile Position Mode

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

Enable Profile Position Mode
To enable the Profile Position Mode, the value 0001h must be written to the mode of operation
OD entry, located at dictionary address 6060h. The mode of operation can be verified using OD 6061h - mode of operation display - which is updated when the current operation mode is accepted.

Set Running Parameters
Set the distance, velocity, acceleration, and deceleration using OD entries 607Ah, 6081h, 6083h, and 6084h respectively.

Starting/Stopping Motion
After power up or node reset, the drive is in disabled state. The value 0006h must be written to the control word OD entry, located at dictionary address 6040h. This will put the drive into "ready to switch on" state and is ready to enable drive operation. If the value 0006h is not written to the control word first, the drive operation can not be enabled.

To indicate a new set-point and start motion, toggle bit 4 by sending 001Fh to controlword OD entry 6040h.

To enable drive operation, the value 001Fh must be written to the controlword OD entry, located at dictionary address 6040h. This will also signal that there is a new set-point ready. The drive acknowledges the receipt of a valid set-point using bit 12 of the statusword at OD 6041h. Because the set-point is edge-triggered, once the drive receives and processes the set-point, the new set-point of the controlword must be cleared by writing 000Fh to the controlword register.

While the drive is acting on a set-point, a new set-point may be entered and triggered using the new set-point. The second set-point will be received as soon as it is processed, or at the end of the previous set-point, which ever is later.

Controlword Bits
New Set-point (bit 4) - set this bit high to clock in a new set-point. Once the drive has accepted the set-point, it will respond by setting statusword bit 12 high. Controlword bit 4 should then be taken low.

Change of Set-point (bit 9) - if this bit is low, the previous set-point will be completed and the motor will come to rest before a new set-point is processed. If bit 9 is high, the motor will continue at the speed commanded by the previous set-point until it has reached the position commanded by the previous set-point, then transition to the speed of the new set-point.

Change Set-point Immediately (bit 5) - if this bit is high, the new set-point will take effect immediately. The motor speed will transition to the speed and position commanded by the new set-point.

Abs/rel (bit 6) - if this bit is high, the set-point distance is relative. For example, if the previous motor position was 10,000 steps and a new set-point is issued with a distance of 20,000, the final position will be 30,000. If bit 6 is low, the distance is absolute. If the previous motor position was 10,000 and a new set-point is issued with a distance of 20,000, the new position will be 20,000. (The distance traveled from the previous position to the new position will be 10,000 steps.) For best results, do not change this bit while the motor is moving.

Note: Two set-points can be set up, but if status bit 12 is high, then the buffer is <u>full</u> and another set-point will be ignored.
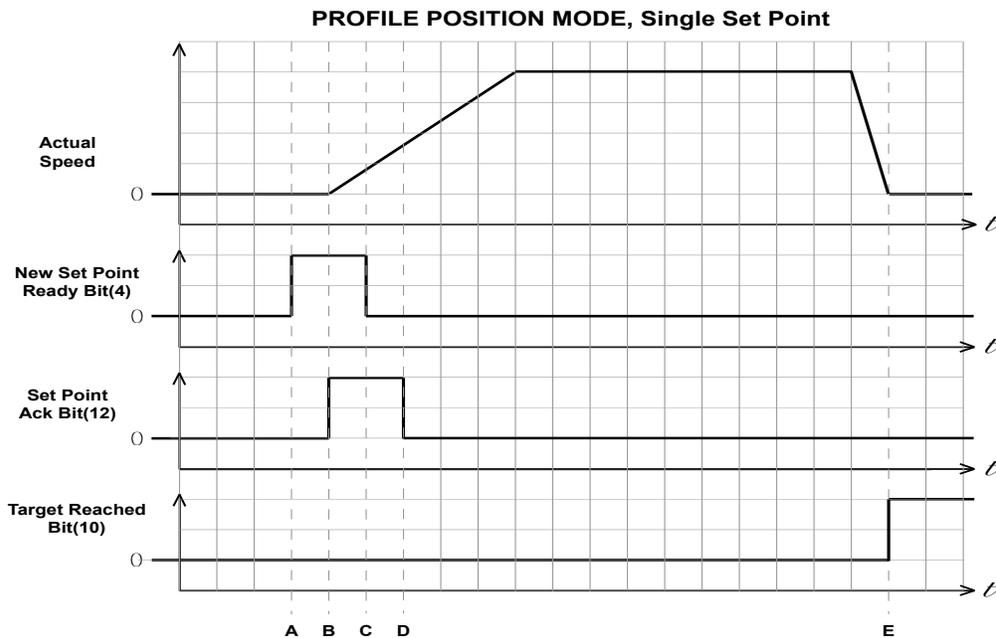
Single Set-Point

Graph Point	New Set-Point Ready Bit	Set-Point Acknowledge Bit	Target Reached Bit	What's Going On
Start	0	0	0	Drive waiting for set-point
A	0 -> 1	0	0	User tells drive a set-point is ready
B	1	0 -> 1	0	Drive acknowledges set-point, starts executing set-point
C	1 -> 0	1	0	User pulls new set-point ready bit low
D	0	1 -> 0	0	Drive pulls set-point ack bit low, indicating ready to receive another set-point
E	0	0	1	The set-point is finished, and the Target Reached bit is set

Single Set-Point Profile Position Move

PROFILE POSITION MODE, Set of Set Points
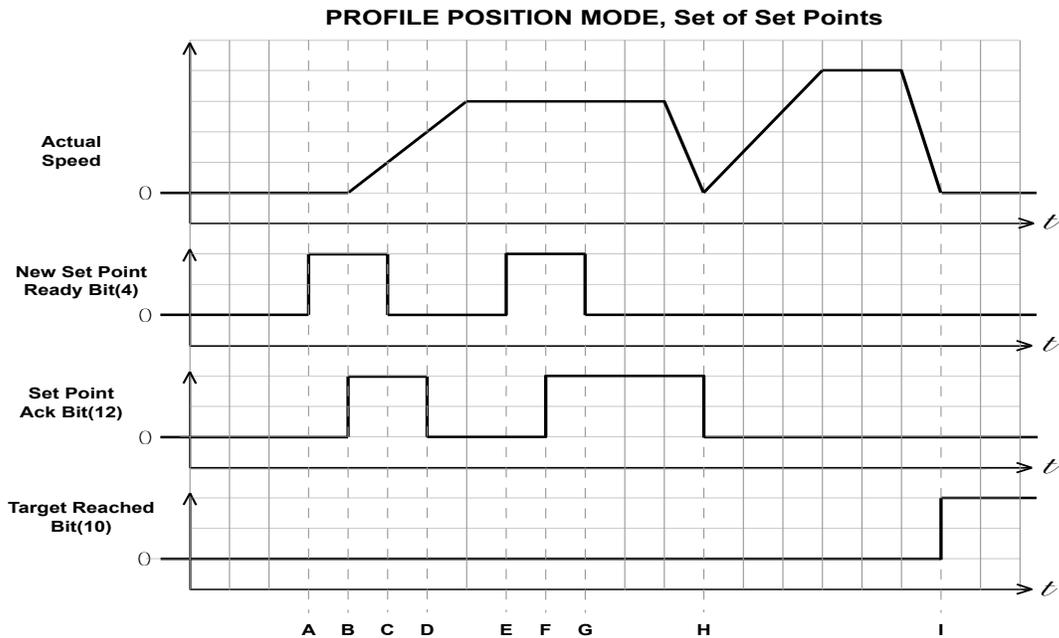
Multiple Set-Points, Stopping Between Moves

In this example, controlword bits 9 (Change of Set-point) and 5 (Change Set Immediately) are 0. The motor comes to rest between moves.

Graph Point	New Set-Point Ready Bit	Set-Point Acknowledge Bit	Target Reached Bit	What's Going On
Start	0	0	0	Drive waiting for set-point
A	0 -> 1	0	0	User tells drive a set-point is ready
B	1	0 -> 1	0	Drive acknowledges set-point, starts executing set-point
C	1 -> 0	1	0	User pulls new set-point ready bit low
D	0	1 -> 0	0	Drive pulls set-point ack bit low, indicating ready to receive another set-point
E	0 -> 1	0	0	User tells drive another set-point is ready
F	1	0 -> 1	0	Drive acknowledges set-point, buffers it as another set-point is still in progress
G	1 -> 0	1	0	User pulls new set-point ready bit low
H	0	1 -> 0	0	Drive pulls set-point ack bit low, starts executing new set-point as soon as old one is finished
I	0	0	1	The set-point is finished, no set-points in buffer, so Target Reached bit is set

Multiple Set-Point Profile Position Move with Stopping Between Moves
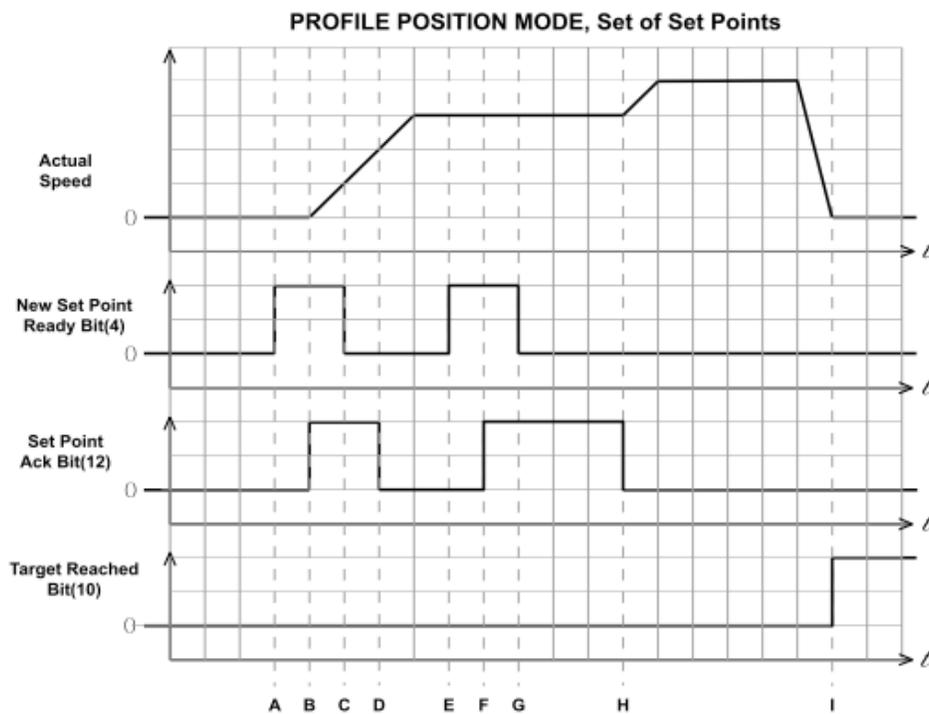
Multiple Set-Points, Continuous Motion

In this example, controlword bit 9 (Change of Set-point) is 1 and controlword bit 5 (Change Set Immediately) is 0. The motor continues at the speed of the first set-point until is reaches the distance of the first set-point, then changes to the new set-point speed. The motion is continuous.

Graph Point	New Set-Point Ready Bit	Set-Point Acknowledge Bit	Target Reached Bit	What's Going On
Start	0	0	0	Drive waiting for set-point
A	0 -> 1	0	0	User tells drive a set-point is ready
B	1	0 -> 1	0	Drive acknowledges set-point, starts executing set-point
C	1 -> 0	1	0	User pulls new set-point ready bit low
D	0	1 -> 0	0	Drive pulls set point ack bit low, indicating ready to receive another set-point
E	0 -> 1	0	0	User tells drive another set-point is ready
F	1	0 -> 1	0	Drive acknowledges set-point, buffers it, as another set-point is still in progress
G	1 -> 0	1	0	User pulls new set-point ready bit low
H	0	1 -> 0	0	Drive pulls set-point ack bit low, starts executing new set-point as soon as the old one is finished
I	0	0	1	The set-point is finished, no set-points in buffer, so Target Reached bit is set

Multiple Set-Point Profile Position Move with Continuous Motion

PROFILE POSITION MODE, Set of Set Points
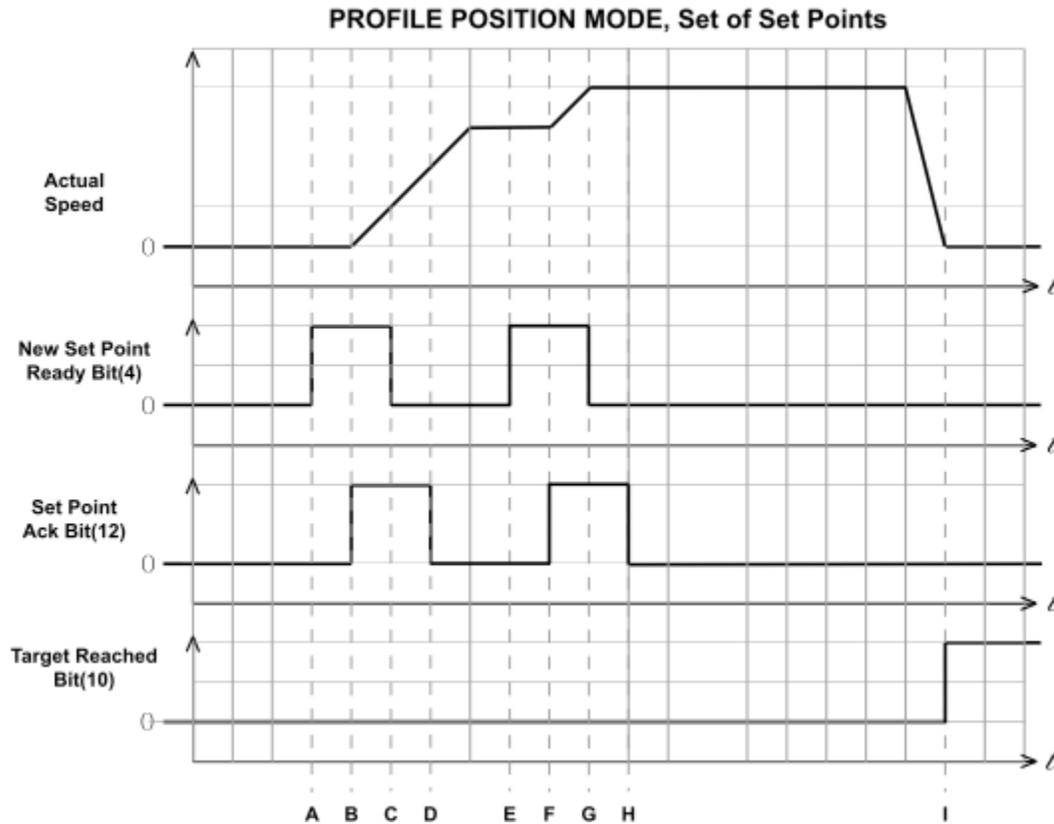
Multiple Set-Points, Immediate Change in Motion

In this example, controlword bit 9 (Change of Set-point) is 1 and controlword bit 5 (Change Set Immediately) is 1. The motor immediately changes to the new set-point speed without completing the first set-point. The motion is continuous.

Graph Point	New Set Point Ready Bit	Set-Point Acknowledge Bit	Target Reached Bit	What's Going On
Start	0	0	0	Drive waiting for set-point
A	0 -> 1	0	0	User tells drive a set-point is ready
B	1	0 -> 1	0	Drive acknowledges set-point, starts executing set-point
C	1 -> 0	1	0	User pulls new set-point ready bit low
D	0	1 -> 0	0	Drive pulls set point ack bit low, indicating ready to receive another set-point
E	0 -> 1	0	0	User tells drive another set-point is ready
F	1	0 -> 1	0	Drive acknowledges set-point, immediately executes it, beginning transition to new set-point speed and position
G	1 -> 0	1	0	User pulls new set-point ready bit low
H	0	1 -> 0	0	Drive pulls set-point ack bit low
I	0	0	1	The set-point is finished, no set-points in buffer, so Target Reached bit is set

Multi-Set-Point Profile Position Move with Immediate Change in Motion

Profile Velocity Mode

General Mode Description

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

The figure below shows an example of Profile Velocity Mode. The top graph shows the actual speed of the motor, the middle graph the target speed value, and the bottom graph the halt bit in the controlword.

The table below explains how the halt bit and target velocity may be used together to affect motor speed. Between points B and C, the motor does not come to a complete stop, but decelerates according to the profile deceleration value starting at point B. When the halt bit transitions at point C, it accelerates immediately back to the target speed. At Point E, reducing the target speed to zero has the same effect as enabling the halt bit, since the drive is commanding the motor to move at zero speed.

It should be noted that both enabling the halt bit and setting the target velocity to zero keep torque applied to the motor. In order to allow the shaft to move freely, the drive's state must be put in the Drive Disabled state.

Enable Profile Velocity Mode

To enable the Profile Velocity Mode, the value 0003h must be written to the mode of operation OD entry, located at dictionary address 6060h. The mode of operation can be verified using OD 6061h – mode of operation display – which is updated when the current operation mode is accepted.

Set Running Parameters

Set the velocity, acceleration, and deceleration using OD entries 60FFh, 6083h, and 6084h respectively.

Enable Drive Operation

After power up or node reset, the drive is in disabled state. The value 0006h must be written to the control word OD entry, located at dictionary address 6040h. This will put the drive into "ready to switch on" state and is ready to enable drive operation. If the value 0006h is not written to the control word first, the drive operation can not be enabled.

To enable drive operation, the value 010Fh must be written to the controlword OD entry, located at dictionary address 6040h. This puts the drive into Operation Enabled state, with the motion halted.

Starting/Stopping Motion

To start and stop motion, toggle the controlword halt bit (bit 8). When the halt bit is set to 0, motion will start or continue; when the halt bit is set to 1, motion will stop. The bit can be toggled by writing 010Fh and 000Fh to controlword OD entry 6040h.
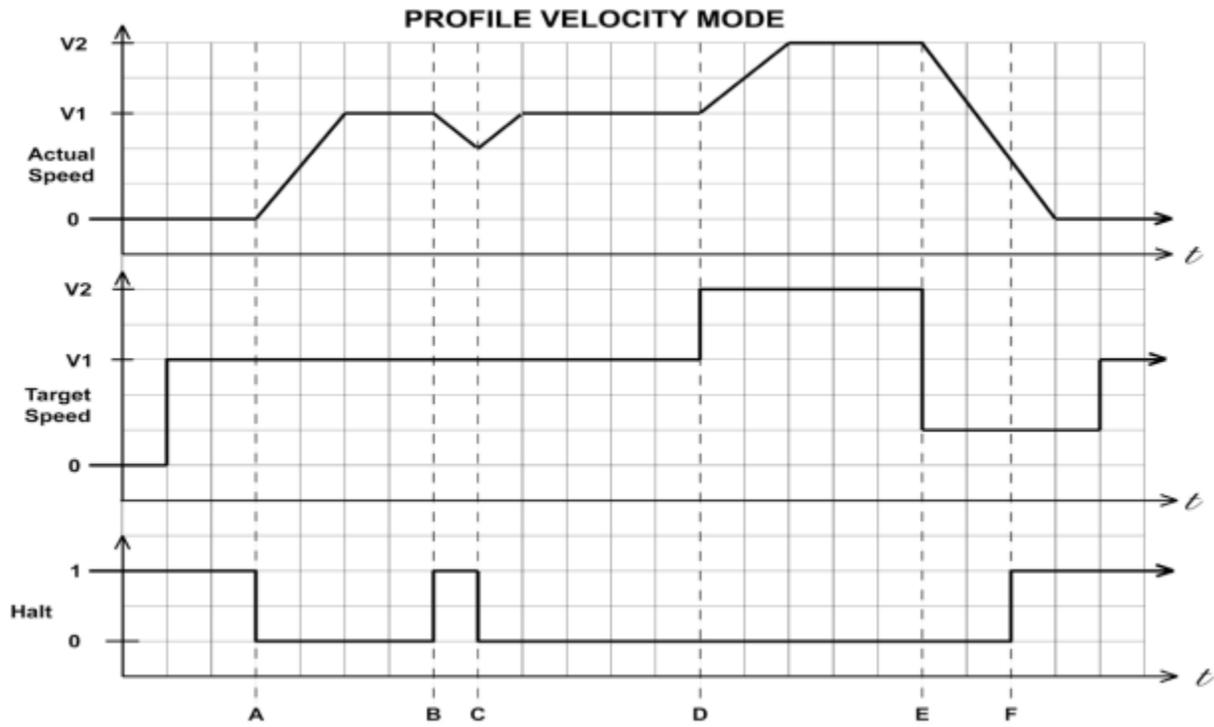
Profile Velocity Mode

Graph Point	Target Speed	Halt Bit	Drive command to Motor
Start	0	1	Motor stopped
A	V1	1 -> 0	Motor accelerates to speed V1
B	V1	0 -> 1	Motor decelerates to stopped
C	V1	1 -> 0	Motor accelerates to V1
D	V1 -> V2	0	Motor accelerates from V1 to V2
E	V2 -> 0	0	Motor decelerates from V2 to 0
F	0	0 -> 1	Motor remains stopped
G	0 -> V1	1	Motor remains stopped

Profile Velocity Mode Example

Cyclic Synchronous Position Mode

General Mode Description

In this mode the master controller generates a trajectory and sends target position (0x607A) to the drive at every PDO update cycle. The primary feedback from the drive is the actual motor position and optionally, actual motor velocity and torque. Position, velocity, and torque control loops are all closed in the drive which acts as a follower for the position commands.

Enable Cyclic Synchronous Position Mode

To enable the Cyclic Synchronous Position mode, the value 0008h must be written to the mode of operation OD entry, located at dictionary address 6060h. The mode of operation can be verified using OD 6061h - mode of operation display - which is updated when the current operation mode is accepted.

Enable Drive Operation

After power up or node reset, the drive is in disabled state. The value 0006h must be written to the control word OD entry, located at dictionary address 6040h. This will put the drive into "ready to switch on" state and is ready to enable drive operation. If the value 0006h is not written to the control word first, the drive operation can not be enabled.

To enable drive operation, the value 000Fh must be written to the controlword OD entry, located at dictionary address 6040h. This puts the drive into Operation Enabled state.

Homing Mode

Set Running Parameters

Set the homing and index velocities, acceleration/deceleration, offset and home sensor (if required) using OD entries 6099h, 609Ah, 607Ch, and 2001h respectively.

Note: It is important that the limit switch settings have been defined in configuration software prior to using the CANopen Homing Mode.

Enable Homing Mode

To enable Homing Mode, the value 0006h must be written to the mode of operation OD entry, located at dictionary address 6060h. The mode of operation can be verified using OD 6061h - mode of operation display - which is updated when the current operation mode is accepted.

After power up or node reset, the drive is in disabled state. The value 0006h must be written to the control word OD entry, located at dictionary address 6040h. This will put the drive into "ready to switch on" state and is ready to enable drive operation. If the value 0006h is not written to the control word first, the drive operation can not be enabled.

To put the drive into Operation Enabled Mode, write 000Fh to the controlword OD entry, located at dictionary address 6040h.

Starting the Homing Procedure

Set the Homing Method required using OD entry 6098h. To start the homing procedure, bit 4 of the controlword OD entry located at dictionary address 6040h, must transition from 0 to 1. The status of the homing procedure can be monitored using the statusword OD entry 6041h.

Homing Method Diagrams
Homing Method 17
Homes to the CCW limit switch.

HOMING MODE #17

Index Pulse	Unused
Home Switch	Unused
Neg Limit Switch	
Pos Limit Switch	Unused
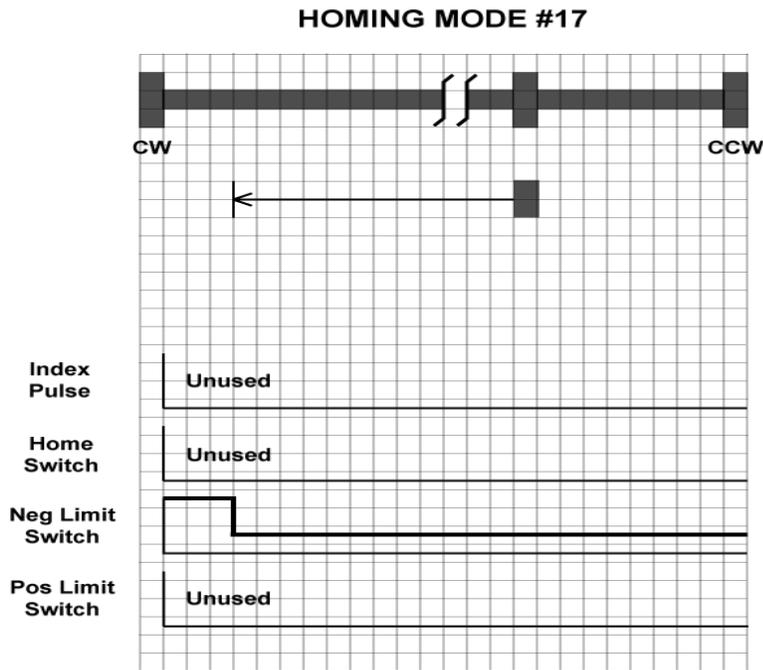
Homing Method 18
Homes to the CW limit switch.

HOMING MODE #18

Index Pulse	Unused
Home Switch	Unused
Neg Limit Switch	Unused
Pos Limit Switch	
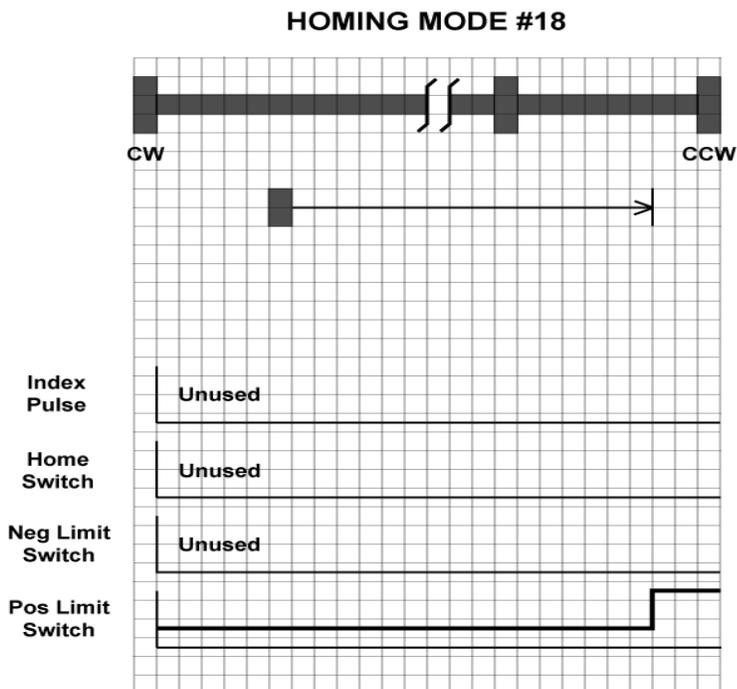
Homing Methods 19 and 20
Home to the home switch transition.

HOMING MODE #19
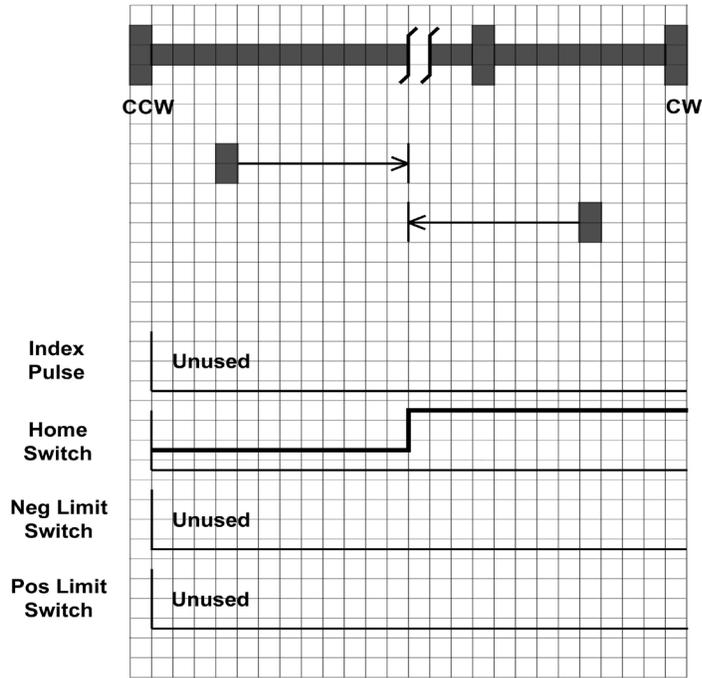
HOMING MODE #20
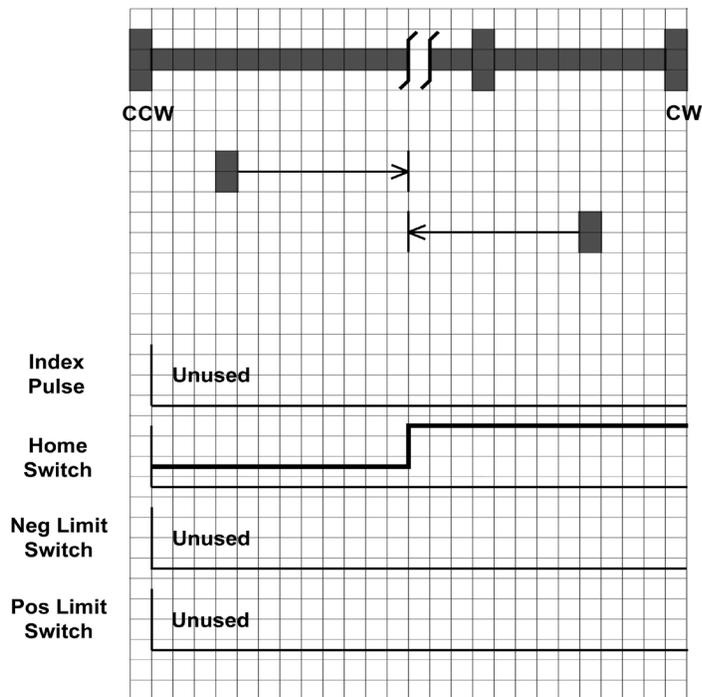
Homing Methods 21 and 22
Home to the home switch transition.

HOMING MODE #21
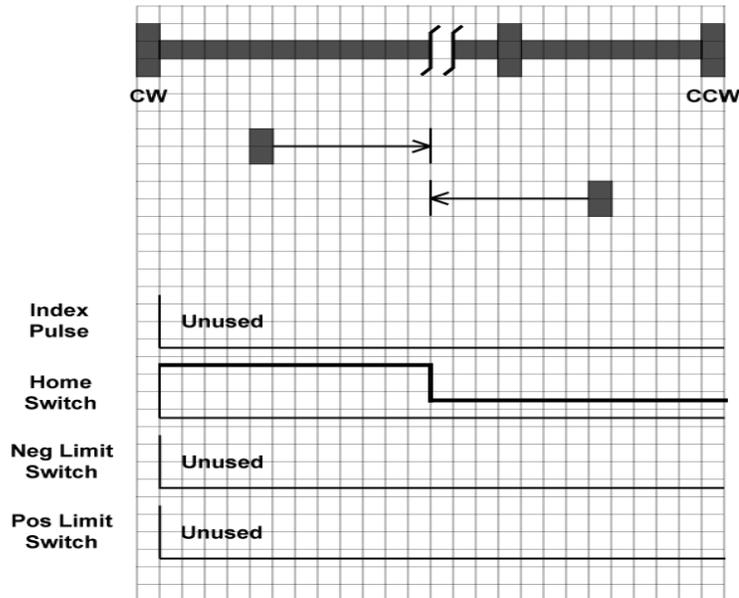
HOMING MODE #22
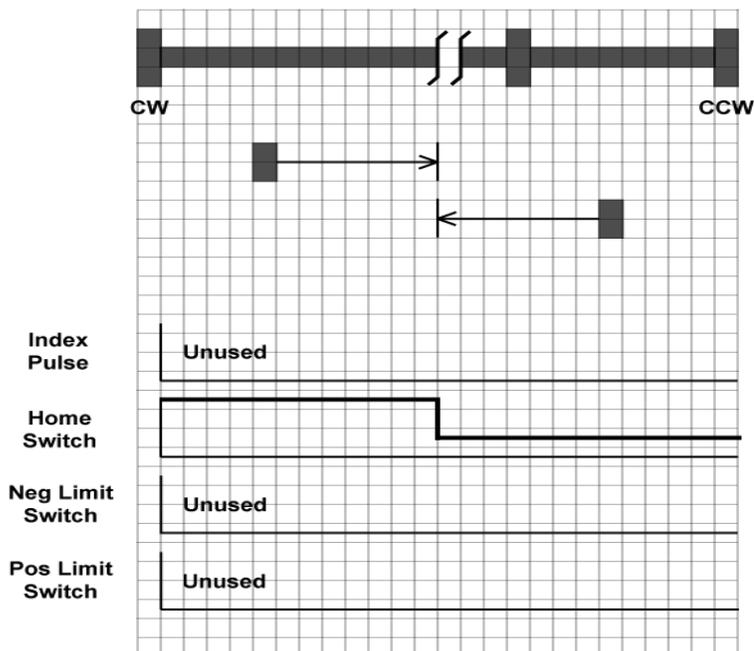
Homing Methods 23 and 24
Home to the home switch transition shown below, and "bounce off" the CW limit, if required.

HOMING MODE #23
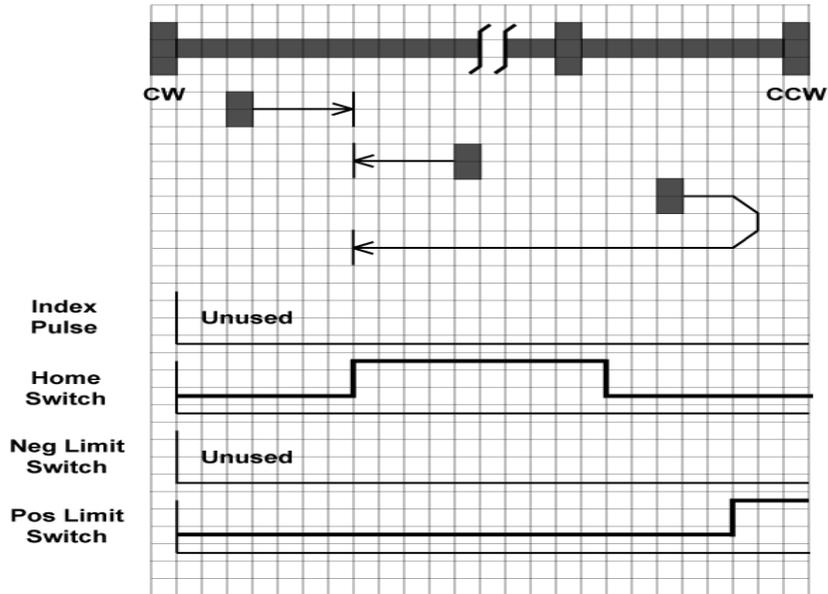
HOMING MODE #24
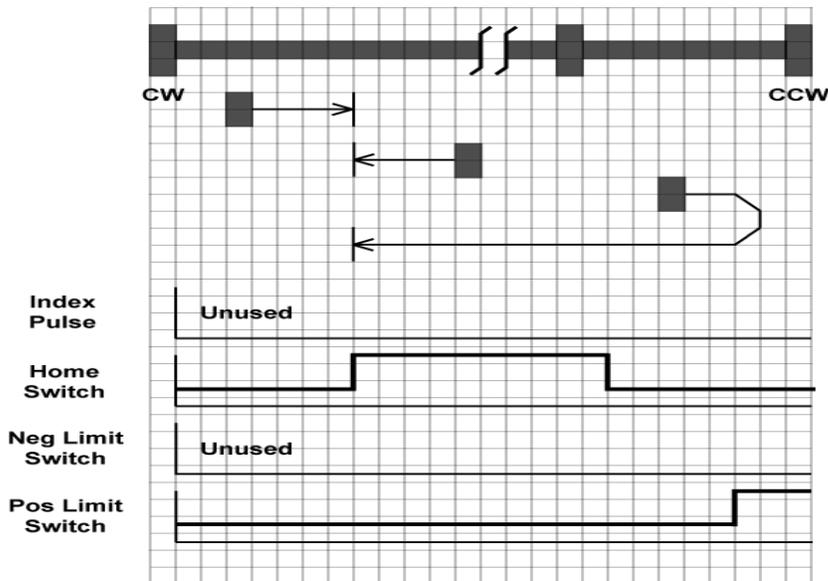
Homing Methods 25 and 26
Home to the home switch transition shown below, and "bounce off" the CW limit, if required.

HOMING MODE #25

Index Pulse — Unused
Home Switch
Neg Limit Switch — Unused
Pos Limit Switch

HOMING MODE #26

Index Pulse — Unused
Home Switch
Neg Limit Switch — Unused
Pos Limit Switch
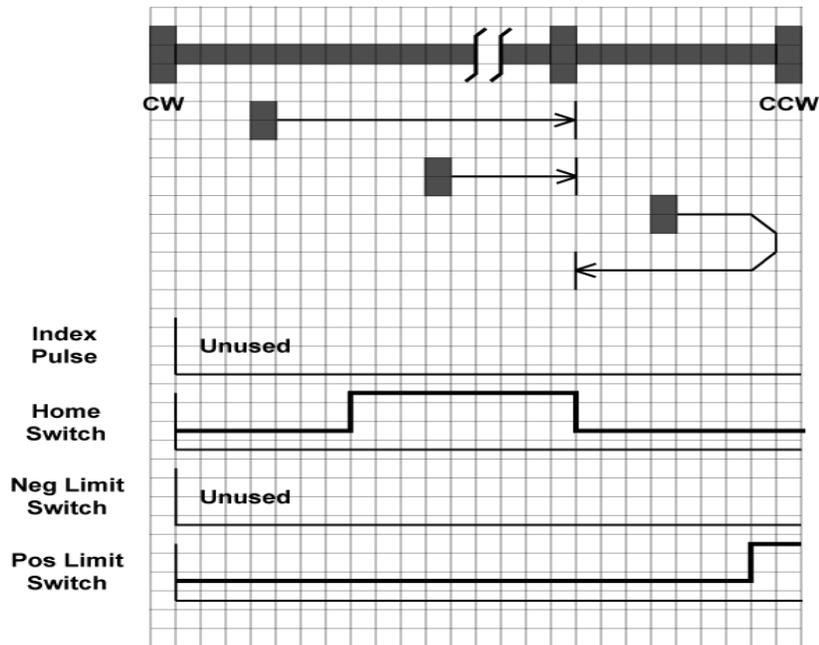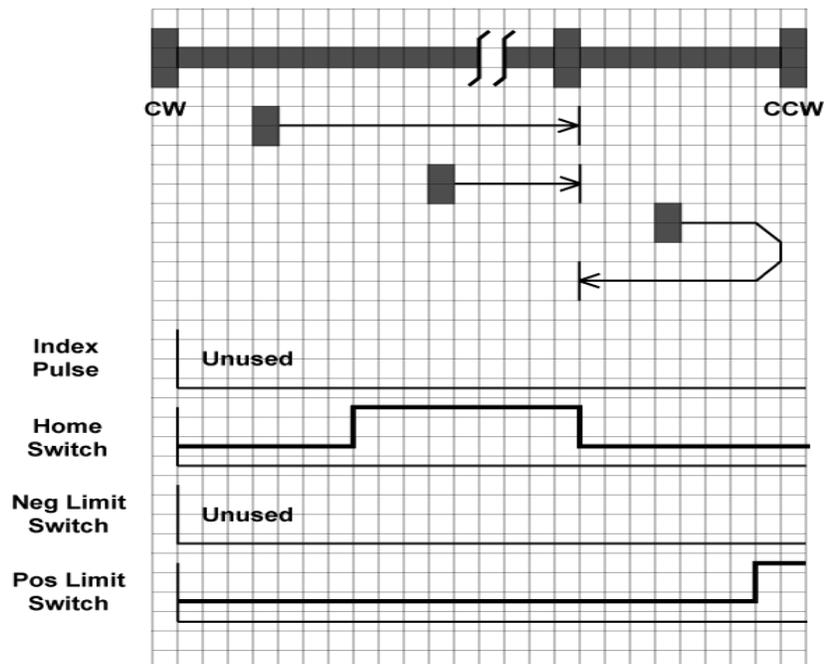
Homing Methods 27 and 28
Home to the home switch transition shown below, and "bounce off" the CCW limit, if required.

HOMING MODE #27
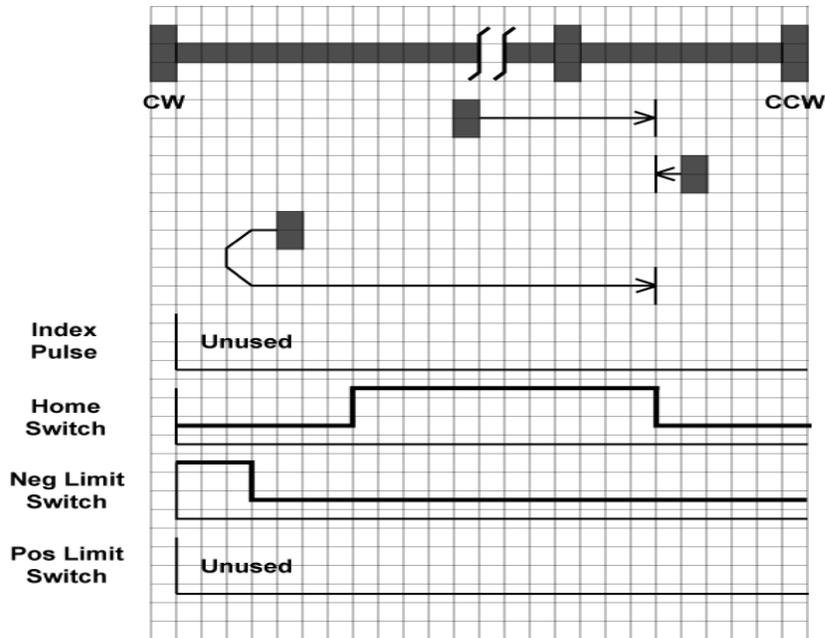
HOMING MODE #28
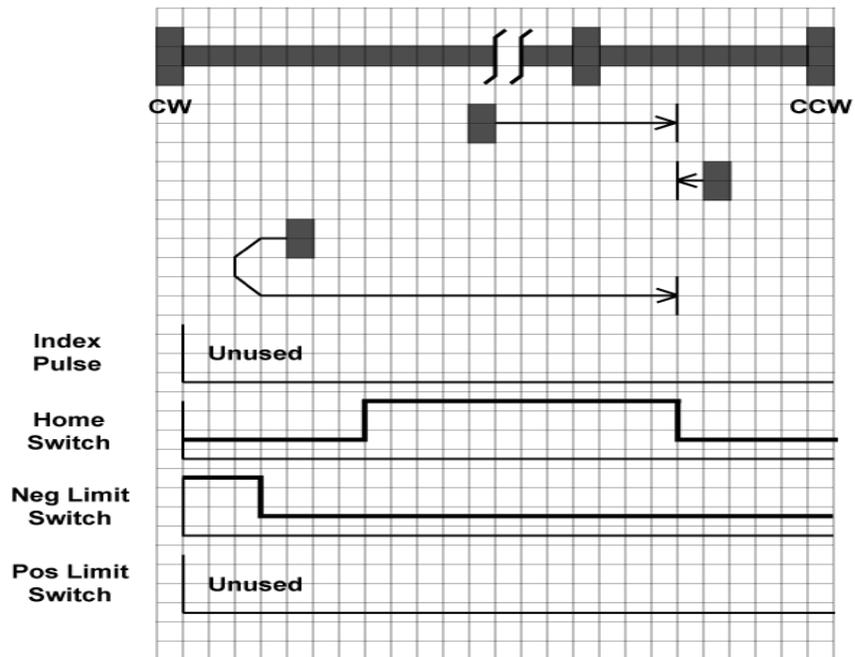
Homing Methods 29 and 30
Home to the home switch transition shown below, and "bounce off" the CW limit, if required.

HOMING MODE #29
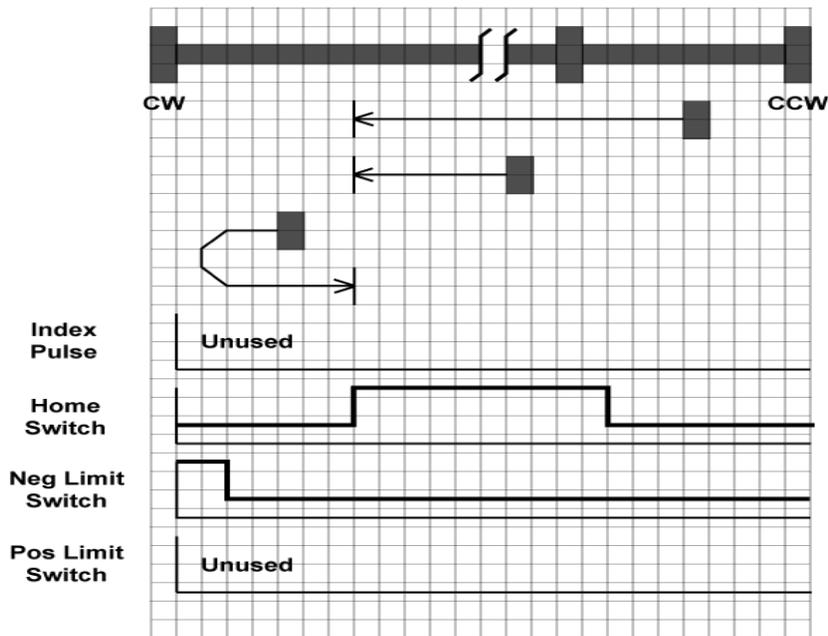
HOMING MODE #30
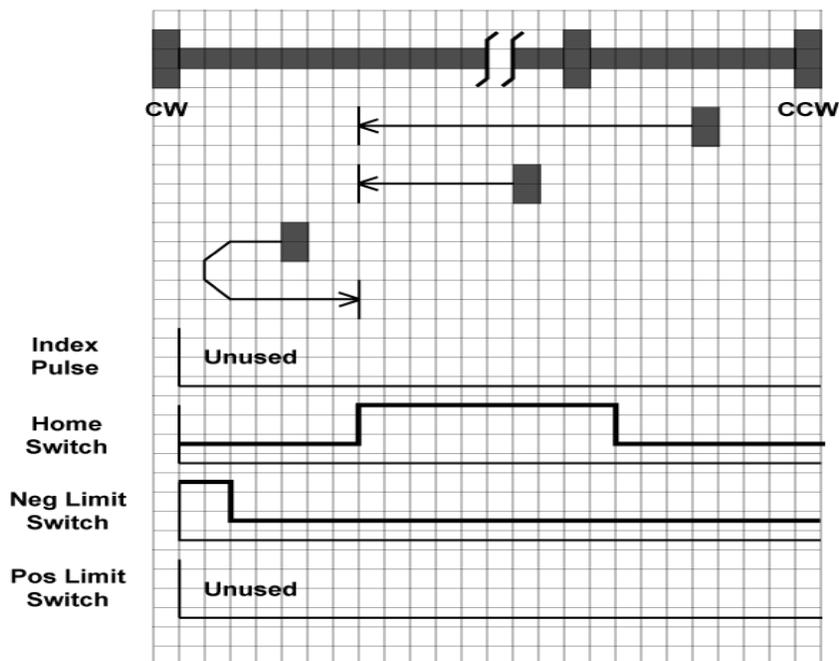
Homing Method 35
Takes the current position to be the home position.

HOMING MODE #35
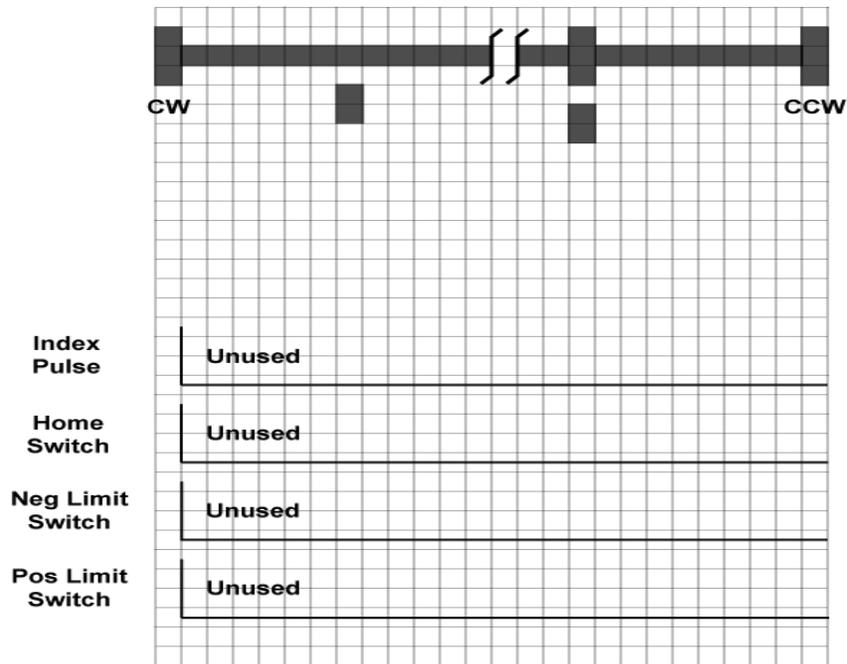
Q Program Mode

General Mode Description

In order to expand the functionality of Applied Motion Products EtherCAT drives, the Q programming language may be used to execute complex motion profiles that may not be possible within the scope of CiA 402. The Q program must be written and pre-loaded into the EtherCAT drive using Q programmer integrated in the configuration software.

Q Program Execution

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

Next, the desired Q segment number, 1-12, must be written to the Q Segment Number register, located at address 2007h.

After power up or node reset, the drive is in disabled state. The value 0006h must be written to the control word OD entry, located at dictionary address 6040h. This will put the drive into "ready to switch on" state and is ready to enable drive operation. If the value 0006h is not written to the control word first, the drive operation can not be enabled.

To enable drive operation, a value of 000Fh must be written to the controlword OD entry, located at dictionary address 6040h. This puts the drive into Operation Enabled state and ready to run the Q program.

To run the selected Q program, a value of 001Fh must be written to the controlword. The Q program will then run to completion. The Q program may be re-executed by a 0->1 transition of the Q Program start bit (bit 4) in the controlword.

To halt execution of a Q program, the halt bit (bit 8) of the controlword must be set to 1. The Q program will halt immediately and start from the beginning the next time a 0->1 transition is seen on the Q Program start bit after the halt bit has been cleared.

Touch Probe

Touch Probe is a latching function to capture the position value of the motor by sensing the edge-triggered digital input of the drive. STF EtherCAT drive have two digital inputs for touch probe function. Input X7 is used as the touch probe 1 input. Input X8 is used as the touch probe 2 input.

Related Objects:

Index	Object
0x60B8	Touch Probe Function
0x60B9	Touch Probe Status
0x60BA	Touch Probe Position 1 Positive Value
0x60BB	Touch Probe Position 1 Negative Value
0x60BC	Touch Probe Position 2 Positive Value
0x60BD	Touch Probe Position 2 Negative Value

Positive value is captured at "rising edge" of digital input. Negative value is captured at "falling edge" of digital input.

When working with inputs and outputs it is important to remember the designations low and high. If current is flowing into or out of an input or output the logic state for that input/output is defined as low or closed. If no current is flowing, or the input/output is not connected, the logic state is high or open.

Rising edge means the status from low to high. Falling edge means the status from high to low.

For more details of each object, please refer to "Object Dictionary" section of this manual.
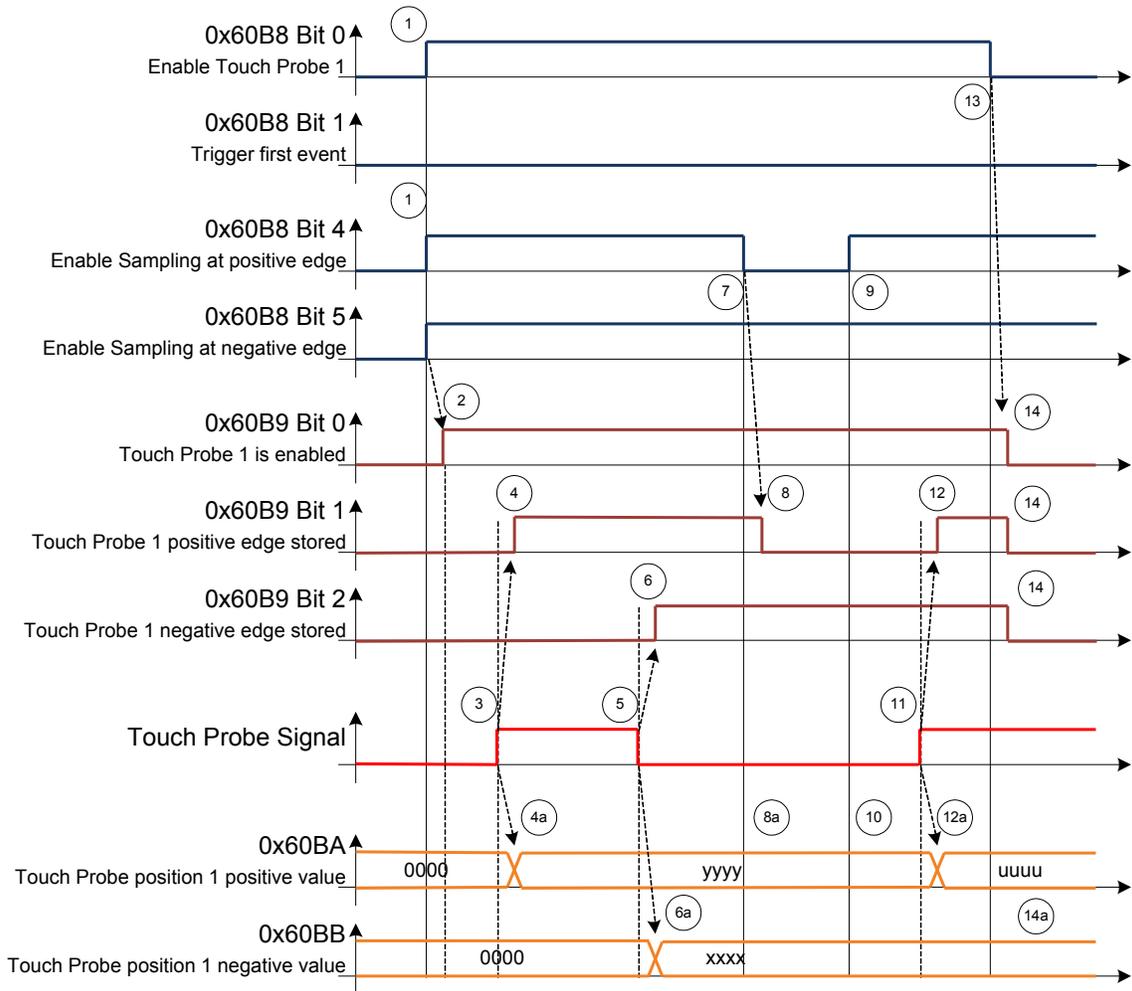
Timing diagram for Touch Probe example

Table 38: Touch Probe Timing example

Number	Touch probe behavior	
(1)	$60B8_h$, Bit 0 = 1	Enable Touch Probe 1,
	$60B8_h$ Bit 1, 4, 5	Configure and Enable Touch Probe 1 positive and negative edge
(2)	$\rightarrow 60B9_h$ Bit 0 = 1	Status "Touch Probe 1 enabled" is set
(3)	External touch probe signal has positive edge	
(4)	$\rightarrow 60B9_h$ Bit 1 = 1	Status "Touch Probe 1 positive edge stored" is set
(4a)	$\rightarrow 60BA_h$	Touch probe position 1 positive value is stored
(5)	External touch probe signal has negative edge	
(6)	$\rightarrow 60B9_h$ Bit 2 = 1	Status "Touch Probe 1 negative edge stored" is set
(6a)	$\rightarrow 60BB_h$	Touch probe position 1 negative value is stored
(7)	$60B8_h$:4	Sample positive edge is disabled
(8)	$\rightarrow 60B9_h$ Bit 0 = 0	Status "Touch Probe 1 positive edge stored" is reset
(8a)	$\rightarrow 60BA_h$	Touch probe position 1 positive value is not changed
(9)	$60B8_h$ Bit 4 = 1	Sample positive edge is enabled
(10)	$\rightarrow 60BA_h$	Touch probe position 1 positive value is not changed
(11)	External touch probe signal has positive edge	
(12)	$\rightarrow 60B9_h$ Bit 1 = 1	Status "Touch Probe 1 positive edge stored" is set
(12a)	$\rightarrow 60BA_h$	Touch probe position 1 positive value is stored
(13)	$60B8_h$ Bit 0 = 0	Touch Probe 1 is disabled
(14)	$\rightarrow 60B9_h$ Bit 0, 1, 2 = 0	Status Bits are reset
(14a)	$\rightarrow 60BA_h$, $60BB_h$	Touch probe position 1 positive/negative value are not changed

Touch Probe Timing example

Object Dictionary

The most important part of a device profile is the Object Dictionary description. The Object Dictionary is essentially a grouping of objects accessible via the network in an ordered predefined fashion. Each object within the dictionary is addressed using a 16-bit index.

Object can be mainly divided into general object (from 0x1000) for EtherCAT communication, CiA402 device profile object (from 0x6000) for CANopen over EtherCAT (CoE), and manufacturer specific object (from 0x2000) exclusively provided by this drive.

General Objects

0x1000 Device Type
This object describes the type of device and its functionality. It is composed of a 16-bit field which describes the device profile that is used and a second 16-bit field which gives additional information about optional functionality of the device.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	ro	no	-

Bit 0~15: Device profile number   0x0192: CiA402
Bit 16~31: Additional information   0x0004: Stepper Drive

0x1008 Device Name
This object provides the name of the device as given by the manufacturer.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	Visible string	ro	no	EtherCAT Drive

0x1009 Hardware Version
This object provides the manufacturer hardware version description.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	Visible string	ro	no	-

0x100A Software Version
This object provides the manufacturer software version description.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	Visible string	ro	no	-

0x1010 Store Parameters

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

Index	Sub Index	Name	PDO Mapping	Default Value
1010	00	max sub-index	no	1
	01	Store Parameters	no	0

You need to write '65766173h' into sub index 01 to save parameters in non-volatile memory.
'65766173h' is the ASCII code for "save".

	MSB			LSB
ASCII	e	v	a	s
Hex	65h	76h	61h	73h

0x1011 Restore Default Parameters

This object supports the restoring of parameters in non-volatile memory.

Index	Sub Index	Name	PDO Mapping	Default Value
1011	00	max sub-index	no	1
	01	Restore Default Parameters	no	0

You need to write '64616F6Ch' into sub index 01 to restore parameters in non-volatile memory.
'64616F6Ch' is the ASCII code for "load".

	MSB			LSB
ASCII	d	a	o	l
Hex	64h	61h	6Fh	6Ch

The parameters which can be stored and restored are:

1600	1st Receive PDO Mapping
1601	2nd Receive PDO Mapping
1602	3rd Receive PDO Mapping
1603	4th Receive PDO Mapping
1A00	1st Transmit PDO Mapping
1A01	2nd Transmit PDO Mapping
1A02	3rd Transmit PDO Mapping
1A03	4th Transmit PDO Mapping
6073	Max Current
607C	Home Offset
6081	Profile Velocity
6083	Profile Acceleration
6084	Profile Deceleration
6085	Quickstop Deceleration

6098	Homing Method
6099	Homing Speed
609A	Homing Acceleration
60FF	Target Velocity
2001	Home Switch
2007	Q Segment Number
201F	Jerk Time
2021	Motor Model
2022	Load Inertia Ratio

0x1018 Identity
This object contains general information about the device.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Array	UNSIGNED32	ro	no	-

Sub Index	Name	Default Value
00	max sub-index	4
01	Vendor ID	0x00000404
02	Product code	2
03	Revision	1
04	Serial number	-

0x1600 ~ 0x1603 RPDO Mapping Parameter
This object contains the mapping parameters for the PDOs the device is able to receive. The sub-index 00h contains the number of valid entries within the mapping record. The number of valid object entries shall be the number of the application objects that shall be received with the corresponding RPDO. The sub-index from 01h to number of entries contains the information of the mapped application variables. 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. The length contains the length of the application object in bit. This may be used to verify the mapping.
The structure of the entries from sub-index 01h – 0Ch is as follows:

MSB		LSB
index (16 bit)	sub-index (8 bit)	object length (8 bit)

0x1600		1st Receive PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	3	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60400010	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60600008	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x607A0020	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1601		2nd Receive PDO **Mapping**		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	3	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60810020	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60830020	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60840020	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1602		3rd Receive PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	1	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60FF0020	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1603		4th Receive PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	2	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60FE0120	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60B80010	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1A00 ~ 0x1A03 TPDO Mapping Parameter

This object contains the mapping for the PDOs the device is able to transmit. The sub-index 00h contains the number of valid object entries within the mapping record. The sub-index from 01h to number of entries 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.

The structure of the entries from sub-index 01h – 0Ch is as follows:

MSB   **LSB**

index (16 bit)	sub-index (8 bit)	object length (8 bit)

0x1A00		1st Transmit PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	3	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x603F0010	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60410010	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60610008	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1A01		2nd Transmit PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	1	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60640020	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1A02		3rd Transmit PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	1	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x606C0020	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1A03		4th Transmit PDO Mapping		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	0 to 12	6	rw	no
Sub Index 1		**Mapping entry 1**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60FD0020	rw	no
Sub Index 2		**Mapping entry 2**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60B90010	rw	no
Sub Index 3		**Mapping entry 3**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60BA0020	rw	no
Sub Index 4		**Mapping entry 4**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60BB0020	rw	no
Sub Index 5		**Mapping entry 5**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60BC0020	rw	no
Sub Index 6		**Mapping entry 6**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	0x60BD0020	rw	no
Sub Index 7		**Mapping entry 7**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 8		**Mapping entry 8**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 9		**Mapping entry 9**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 10		**Mapping entry 10**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 11		**Mapping entry 11**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no
Sub Index 12		**Mapping entry 12**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	0 to 0xFFFFFFFF	-	rw	no

0x1C32 Sync Manager Output Parameter
This object is used to configure the output sync manager.

0x1C32		Sync Manager Output Parameter		
Sub Index 0		**Number of entries**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	-	32	ro	no
Sub Index 1		**Sync type**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	rw	no
Sub Index 2		**Cycle time**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	ro	no
Sub Index 4		**Sync types supported**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0x401F	ro	no
Sub Index 5		**Minimum cycle time**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0x0007A120	ro	no
Sub Index 6		**Calc and copy time**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	ro	no
Sub Index 8		**Get cycle time**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	rw	no
Sub Index 9		**Delay time**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	ro	no
Sub Index 10		**Sync0 cycle time**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	rw	no
Sub Index 11		**SM event missed**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	ro	no
Sub Index 12		**Cycle time too small**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	ro	no
Sub Index 32		**Sync error**		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
BOOL	-	0	ro	no

0x1C33 Sync Manager Input Parameter

This object is used to configure the input sync manager.

0x1C33		Sync Manager Input Parameter		
Sub Index 0		Number of entries		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED8	-	32	ro	no
Sub Index 1		Sync type		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	rw	no
Sub Index 2		Cycle time		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	ro	no
Sub Index 4		Sync types supported		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0x401F	ro	no
Sub Index 5		Minimum cycle time		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0x0007A120	ro	no
Sub Index 6		Calc and copy time		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	ro	no
Sub Index 8		Get cycle time		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	rw	no
Sub Index 9		Delay time		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	ro	no
Sub Index 10		Sync0 cycle time		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED32	-	0	rw	no
Sub Index 11		SM event missed		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	ro	no
Sub Index 12		Cycle time too small		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
UNSIGNED16	-	0	ro	no
Sub Index 32		Sync error		
Data Type	Setting Range	Default Value	Access Type	PDO Mapping
BOOL	-	0	ro	no

CiA402 Device Profile Objects

0x603F Error Code
This object reads back the most recent error code generated by the drive.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	yes	0

The error codes are as below:

Error Code	Description
0x7500	EtherCAT communication error
0xFF01	**Over Current**
0xFF02	**Over Voltage**
0xFF03	**Over Temperature**
0xFF04	**Open Motor Winding**
0xFF05	**Internal Voltage Bad**
0xFF06	**reserved**
0xFF07	**reserved**
0xFF08	**reserved**
0xFF09	**reserved**
0xFF0A	**reserved**
0xFF0B	**reserved**
0xFF31	CW Limit
0xFF32	CCW Limit
0xFF33	**reserved**
0xFF34	**reserved**
0xFF35	Move while Disabled
0xFF36	Under Voltage
0xFF37	Blank Q Segment
0xFF41	Save Failed
0xFFFF	Other Error

Note: Items in represent Drive Faults, which automatically disable the motor.

When Fault happens, after the condition that caused the error has been resolved,
write 80h to object 0x6040 to clear the error code in object 0x603F and object 0x200F.

When Warning happens, after the condition that caused the error has been resolved,
write 01h to object 0x2006 to clear the error code in object 0x603F and object 0x200F.

0x6040 Control Word

This object is used to control the state and motion of the drive. It can be used to enable / disable the driver power output, start, and abort moves in all operating modes, and clear fault conditions.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	yes	0

The bits of the control word are defined as follows:

Bit	Name
0	Switch On
1	Enable Voltage
2	Quick Stop
3	Enable Operation
4	Operation Mode Specific
5	Operation Mode Specific
6	Operation Mode Specific
7	Fault Reset
8	Halt
9	Operation Mode Specific
10	Reserved
11	Manufacturer Specific
12	Manufacturer Specific
13	Manufacturer Specific
14	Manufacturer Specific
15	Manufacturer Specific

Details on Bits 0 to 3 and 7

Command	Bit of Control word				
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0
Shutdown	0	x	1	1	0
Switch on	0	0	1	1	1
Switch on + Enable operation	0	1	1	1	1
Disable voltage	0	x	x	0	x
Quick stop	0	x	0	1	x
Disable Operation	0	0	1	1	1
Enable Operation	0	1	1	1	1
Fault reset	0 -> 1	x	x	x	x

Details on Bits 4, 5, 6, 8 and 9

For PP mode

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

For HM mode

Bit	Name	Value	Description
4	Homing Operation Start	0	Do not start homing procedure
		1	Start or continue homing procedure
8	Halt	0	Enable bit 4
		1	Stop axis

For Q mode

Bit	Name	Value	Description
4	Q Program Start	0	Toggle this bit from 0->1 to run Q program
		1	
8	Halt	0	Enable bit 4
		1	Stop axis

0x6041 Status Word

The object indicates the current state of the drive. It consists of bits that indicate the state according to the drive and operation mode.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	yes	0

The bits of the status word are defined as follows:

Bit	Name
0	Ready to Switch On
1	Switched On
2	Operation Enabled
3	Fault
4	Voltage Enabled
5	Quick Stop
6	Switch On Disabled
7	Warning
8	Manufacturer Specific
9	Remote
10	Target Reached
11	Internal Limit Active
12	Operation Mode Specific
13	Operation Mode Specific
14	Manufacturer Specific
15	Manufacturer Specific

The following bits indicate the status of the device:

State	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
Not Ready to Switch On	0	x	0	0	0	0
Switch On Disabled	1	x	0	0	0	0
Ready to Switch On	0	1	0	0	0	1
Switched On	0	1	0	0	1	1
Operation Enabled	0	1	0	1	1	1
Fault	0	x	1	1	1	1
Fault Reaction Active	0	x	1	1	1	1
Quick Stop Active	0	0	0	1	1	1

Bit 9: Remote
This bit indicates Control word has settled.

Bit 10: Target Reached
If bit 10 is set by the drive, then a set point has been reached (torque, speed or position depending on the modes of operation). The change of a target value by software alters this bit. If quick stop option code is 5, 6, 7 or 8, this bit must be set, when the quick stop operation is finished and the drive is halted. If Halt occurred and the drive has halted then this bit is set too.

Bit 11: Internal Limit Active
This bit set by the drive indicates that an internal limitation is active (e.g. position error limit).

For PP mode

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

For PV mode

Bit	Name	Value	Description
10	Target Reached	0	Halt (Bit 8 in controlword) = 0: Target velocity not reached Halt (Bit 8 in controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in controlword) = 0: Target velocity reached Halt (Bit 8 in controlword) = 1: Velocity of axis is 0
12	Speed	0	Speed is not equal to 0
		1	Speed is equal 0

For HM mode

Bit	Name	Value	Description
10	Target Reached	0	Halt (Bit 8 in controlword) = 0: Home position not reached Halt (Bit 8 in controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in controlword) = 0: Home position reached Halt (Bit 8 in controlword) = 1: Velocity of axis is 0
12	Homing Attained	0	Homing Mode not yet complete
		1	Homing Mode carried out successfully
13	Homing Error	0	No homing error
		1	Homing error

For Q program mode

Bit	Name	Value	Description
10	Target Reached	0	Halt (Bit 8 in controlword) = 0: Q program running Halt (Bit 8 in controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in controlword) = 0: Q program finishes or not started Halt (Bit 8 in controlword) = 1: Velocity of axis is 0

0x6060 Mode of Operation
This object is used to set operation mode.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER8	rw	yes	0

This drive provides the following operation modes:

Value	Mode
-1	Q Program Mode (Applied Motion Products specific)
1	Profile Position Mode (PP)
3	Profile Velocity Mode (PV)
6	Homing Mode (HM)
8	Cyclic Synchronous Position Mode (CSP)

In SM synchronization mode, PP, PV, HM and Q modes are supported.
In DC synchronization mode, CSP and HM modes are supported.

0x6061 Mode of Operation Display
This object displays current operation mode of the drive. Definition of value is same as Mode of Operation (0x6060).

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER8	ro	yes	0

0x6064 Position Actual Value
This object provides the value of the position. The unit of this object is step.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	ro	yes	0

0x606C Velocity Actual Value
This object provides the value of the velocity. The unit of this object is step/s.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	ro	yes	0

0x6073 Max Current
This object configures the max current permissible value of the drive. The unit of this object is 0.01Amps.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	50

0x607A Target Position

This object specifies the target position in Profile Position (PP) mode and Cyclic Synchronous Position (CSP) mode. The unit of this object is step. It is related to electronic gearing setting.

It is used as absolute coordinate or relative coordinate depending on the Bit 6 (0x6040.6) setting of the Control Word in the PP mode, and is always used as absolute value in the CSP mode.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	rw	yes	0

0x607C Home Offset

This object is the difference between the zero position for the application and the home sensor position (found during homing). During homing the home sensor 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. The unit of this object is step.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	rw	yes	0

0x6081 Profile Velocity

This object configures the velocity normally attained at the end of the acceleration ramp during a profiled move and is valid for both directions of motion. This object sets the velocity value except the velocity parameter in Profile Velocity mode (pv). The unit of this object is step/s.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	rw	yes	200000

0x6083 Profile Acceleration

This object configures the acceleration ramp in a profiled move. The unit of this object is step/s2.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	rw	yes	500000

0x6084 Profile Deceleration

This object configures the deceleration ramp in a profiled move. The unit of this object is step/s2.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	rw	yes	500000

0x6085 Quickstop Deceleration

This object configures deceleration used to stop the motor when the quick stop function is activated. The unit of this object is step/s2.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	rw	no	20000000

0x6098 Homing Method

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

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER8	rw	yes	0

Please see the detail described in Homing Mode.

0x6099 Homing Speed

This object determines the speeds that will be used during homing.
There are two parts to define those speeds.
Sub-index 1 to set the speed to search home switch.
Sub-index 2 to set the speed to search zero position.
The unit of this object is step/s.

Object Type	Data Type	Access Type	Default Value
Array	UNSIGNED32	rw	0

Sub Index	Name	PDO Mapping	Default Value
00	max sub-index	no	2
01	speed during search for switch	yes	0
02	speed during search for zero	yes	0

0x609A Homing Acceleration

This object establishes the acceleration to be used for all accelerations and decelerations with the standard homing modes. The unit of this object is step/s2.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	rw	yes	0

0x60B8 Touch Probe Function

This object configures the function of touch probe.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	yes	0

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	Trigger continuously
2, 3	00	Trigger with touch probe 1 input
	01	reserved
	10	reserved
	11	reserved
4	0	Switch off sampling at rising edge of touch probe 1
	1	Enable sampling at rising edge of touch probe 1
5	0	Switch off sampling at falling edge of touch probe 1
	1	Enable sampling at falling edge of touch probe 1
6, 7	-	reserved
8	0	Switch off touch probe 2
	1	Enable touch probe 2
9	0	Trigger first event
	1	Trigger continuously
10, 11	00	Trigger with touch probe 2 input
	01	reserved
	10	reserved
	11	reserved
12	0	Switch off sampling at rising edge of touch probe 2
	1	Enable sampling at rising edge of touch probe 2
13	0	Switch off sampling at falling edge of touch probe 2
	1	Enable sampling at falling edge of touch probe 2
14, 15	-	reserved

Positive value is captured at "rising edge" of digital input. Negative value is captured at "falling edge" of digital input.

When working with inputs and outputs it is important to remember the designations low and high. If current is flowing into or out of an input or output the logic state for that input/output is defined as low or closed. If no current is flowing, or the input/output is not connected, the logic state is high or open.

Rising edge means the status from low to high. Falling edge means the status from high to low.

0x60B9 Touch Probe Status
This object provides the status of touch probe.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	yes	0

Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no rising edge value stored
	1	Touch probe 1 rising edge position stored
2	0	Touch probe 1 no falling edge value stored
	1	Touch probe 1 falling edge position stored
3 - 7	0	reserved
8	0	Touch probe 2 is switched off
	1	Touch probe 2 is enabled
9	0	Touch probe 2 no rising edge value stored
	1	Touch probe 2 rising edge position stored
10	0	Touch probe 2 no falling edge value stored
	1	Touch probe 2 falling edge position stored
11 - 15	0	reserved

0x60BA Touch Probe Position 1 Positive Value
This object provides the position value triggered by Touch Probe 1 at rising edge.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	ro	yes	0

0x60BB Touch Probe Position 1 Negative Value
This object provides the position value triggered by Touch Probe 1 at falling edge.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	ro	yes	0

0x60BC Touch Probe Position 2 Positive Value
This object provides the position value triggered by Touch Probe 2 at rising edge.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	ro	yes	0

0x60BD Touch Probe Position 2 Negative Value

This object provides the position value triggered by Touch Probe 2 at falling edge.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	ro	yes	0

0x60FD Digital Inputs

This object monitors the inputs status of the drive.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	ro	yes	0x00FF0000

bit 0	CCW Limit	A "0" means no limit alarm.
bit 1	CW Limit	A "1" means limit alarm occurs.
bit 2	Home Sensor	A "0" means home sensor is not active. A "1" means home sensor is active.
bit 3~15		reserved
bit 16	Input X1	
bit 17	Input X2	
bit 18	Input X3	
bit 19	Input X4	A "0" means the input is open. A "1" means the input is closed.
bit 20	Input X5	
bit 21	Input X6	
bit 22	Input X7	
bit 23	Input X8	
bit 24~31		reserved

When working with inputs and outputs it is important to remember the designations low and high. If current is flowing into or out of an input or output the logic state for that input/output is defined as low or closed. If no current is flowing, or the input/output is not connected, the logic state is high or open.

0x60FE Digital Outputs
This object configures or monitors the digital outputs of the drive.

Object Type	Data Type	Access Type	Default Value
Array	UNSIGNED32	rw	0

Sub Index	Name	PDO Mapping	Default Value
00	max sub-index	no	2
01	physical outputs	yes	0x00000000
02	bit mask	no	0x00000000

Description of physical outputs:
Bit 0~15 are reserved.
Bit 16~19 are for outputs Y1 ~ Y4 correspondingly.
Bit 20~31 are reserved.
A "0" turns an output on (closed). A "1" turns an output off (open).

Example:
0x000F0000   Turn off all four outputs.
0x000A0000   Turn on Y1 and Y3. Turn off Y2 and Y4.

Description of bit mask:
Bit 0~15 are reserved.
Bit 16~19 are for outputs Y1 ~ Y4 correspondingly.
Bit 20~31 are reserved.
A "0" deselects (mask off) an output. A "1" selects an output.

Example:
0x000F0000   Select all four outputs.
0x000A0000   Deselect (mask off) Y1 and Y3. Select Y2 and Y4.

0x60FF Target Velocity

This object configures the velocity parameters in Profile Velocity Mode. The unit of this object is step/s.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	INTEGER32	rw	yes	200000

0x6502 Supported Drive Modes

This object provides information on the supported drive modes.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	ro	no	165

Bit	Description
0	PP: Profile Position Mode
1	Vl: Velocity Mode
2	PV: Profile Velocity Mode
3	TQ: Torque Profile Mode
4	reserved
5	HM: Homing Mode
6	IP: Interpolated Position Mode
7	CSP: Cyclic Sync Position Mode
8	CSV: Cyclic Sync Velocity Mode
9	CST: Cyclic Sync Torque Mode
10~31	reserved

Bit value 0: Not supported.
Bit value 1: Supported.
STF EtherCAT drive now supports PP, PV, HM, CSP modes.

Manufacturer Specific Objects

0x2001 Home Switch

This object configures which input is used as the home switch in Homing.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED8	rw	no	8

0x2002 Output Status

This object reads back the status of the drive's outputs.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	ro	no	0x000F0000

Bit 0~15 are reserved.
Bit 16~19 are for outputs Y1 ~ Y4 correspondingly.
Bit 20~31 are reserved.
A "0" means the output is closed. A "1" means the output is open.

Example:
0x000F0000   All four outputs of the drive are open.
0x000A0000   Outputs Y1 and Y3 are closed. Output Y2 and Y4 are open.

0x2006 Clear Alarm

This object provides the feature to clear alarm of the drives. After the condition that caused the error has been resolved, set this value to 01h can clear the error code in object 0x603F and object 0x200F

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED8	wo	no	0

0x2007 Q Segment Number

This object configures the number of Q Segment which will be executed in Q mode.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED8	rw	yes	1

0x200B Status Code

This object represents the current status code of the drive.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	ro	yes	0

Hex Value	Status Code bit definition
0001	Motor Enabled (Motor Disabled if this bit = 0)
0002	Sampling (for Quick Tuner)
0004	Drive Fault (check Alarm Code)
0008	In Position (motor is in position)
0010	Moving (motor is moving)
0020	Jogging (currently in jog mode)
0040	Stopping (in the process of stopping from a stop command)
0080	Waiting (for an input; executing a WI command)
0100	Saving (parameter data is being saved)
0200	Alarm present (check Alarm Code)
0400	Homing (executing an SH command)
0800	Waiting (for time; executing a WD or WT command)
1000	Wizard running (Timing Wizard is running)
2000	Checking encoder (Timing Wizard is running)
4000	Q Program is running
8000	Initializing (happens at power up)

0x200C Zero Position

This object provides the feature to clear the position value in 0x6064 (Position actual value).
Set this value to 01h can clear the position value in 0x6064 (Position actual value).

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED8	wo	no	0

0x200F Alarm Code
This object reads back a hexadecimal value of the most recent alarm code of the drive.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED32	ro	yes	0

Each bit in alarm code indicates one type of warnings or faults status.

Hex Value	STF EtherCAT
00000001	Reserved
00000002	CCW Limit
00000004	CW Limit
00000008	**Over Temperature**
00000010	**Internal Voltage Bad**
00000020	**Over Voltage**
00000040	**Under Voltage**
00000080	**Over Current**
00000100	**Open Motor Winding**
00000200	Reserved
00000400	Communication Error
00000800	Bad Flash
00001000	No Move
00002000	NV Memory Error
00004000	Blank Q Segment
00008000	NV Memory Double Error

Note: Items in **bold** represent Drive Faults, which automatically disable the motor.

When Fault happens, after the condition that caused the error has been resolved,
write 80h to object 0x6040 to clear the error code in object 0x603F and object 0x200F.

When Warning happens, after the condition that caused the error has been resolved,
write 01h to object 0x2006 to clear the error code in object 0x603F and object 0x200F.

0x2019 Drive Temperature
This object reads back the drive's temperature measured by on board temperature sensor.
The unit of this object is 0.1 centigrade.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	no	-

0x201F S-curve Filter Time
This object sets the S-Curve Filter time when using S curve acceleration/deceleration.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	0

0x2020 Physical Address
This object reads the physical drive address set by the drive's rotary switch.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	no	0

0x2021 EtherCAT ID
This object reads back the EtherCAT ID of the drive.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	no	-

0x2022 Alisa Source
This object reads the souce of EtherCAT address setting
        0 means sets by driver's rotary switch
        1 means defined by EtherCAT controller

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	no	-

0x2030 Bus Voltage
This object reads back the Drive's bus voltage.
The units of this object is 0.1 voltage.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	ro	no	-

0x2031 DSP Version
This object reads back the DSP firmware version number

Object Type	Data Type	Access Type	PDO Mapping	Default Value
String(10)	UNSIGNED16	ro	no	-

0x2600 Running Current
This object reads and sets the running current of the drive
The units of this object is 0.01A.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

0x2601 Idle Current
This object reads and sets the idel current of the drive
The units of this object is 0.01A.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

0x2602 Idle Current Delay Time
This object reads and sets the idel current delay time of the drive
The units of this object is 1ms.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

0x2603 Acceleration Current
This object reads and sets the idel current delay time of the drive
The units of this object is 0.01A.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

0x2604 Steps per Rev
This object reads and sets the steps per rev of the drive

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	20000

0x2605 Reverse Motor Direction

This object sets the driection of the motor rotation.

> 0 means clockwise (default)
> 1 means anti clockwise (reversed)

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	0

0x2606 Fault Output on Y1

This object sets the fault output function for output Y1.

> 0 means clockwise (default)
> 1 means anti clockwise (reversed)

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	0

0x2607 Brake Output on Y2

This object sets the brake output functions for output Y2.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

Sub Index	Name	PDO Mapping	Default Value
01	Brake output	no	-
02	Brake disengage delay	no	200
03	Brake engage delay	no	200

The units for brake disengage and brake engage delay is ms.

0x2608 Motion Output

This object sets the motion output functions on output Y1/Y2/Y3/Y4.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
	UNSIGNED16	rw	no	-

Sub Index	Name	PDO Mapping	Default Value
01	Motion Output on Y1	no	-
02	Motion Output on Y2	no	-
03	Motion Output on Y3	no	-
04	Motion Output on Y4	no	-

0x2609 Alarm Reset on Input X6

This object sets the alarm reset functions on input X6.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

0x260B Define Limits

This object sets CW and CCW end-of-travel limits are available on all drives and can be used to define the boundaries of acceptable motion in a motor/drive system. If one of these inputs is activated while defined as an end-of-travel limit, motor rotation will stop in that direction, and an alarm code will show at the drive's status LEDs. When defining these inputs as end-of-travel limits, individual or both inputs can be defined as either active low, active high, or not used. See below for details.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
	UNSIGNED16	rw	no	-

1: End-of-travel limit occurs when an input is closed (energized). Motion stops automatically at rate defined by AM command.
2: End-of-travel limit occurs when an input is open (de-energized). Motion stops automatically at rated defined by AM command.
3: Inputs are not used as end-of-travel limit inputs and can be used as a general purpose inputs. DL will be automatically set to 3 if CM is set to 7, 11, 12, 13, 14, 15, 16, 17, or 18, or if JE is executed after the DL command is set.
7: individually set end-of-travel in CW direction when CW Limit inputs is closed(energized).
8: individually set end-of-travel in CW direction when CW Limit inputs is open (de-energized).
9: individually set end-of-travel in CCW direction when CCW Limit inputs is closed(energized).
10: individually set end-of-travel in CCW direction when CCW Limit inputs is open (de-energized).
11~13, DL17~20: Swap the CW input and CCW input definition as above setting..

0x260C Inputs Filter

This object sets fliter time for each of the inputs.
the units for this object is ms

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	-

Sub Index	Name	PDO Mapping	Default Value
01	Input X1 Filter Time	no	0
02	Input X2 Filter Time	no	0
03	Input X3 Filter Time	no	0
04	Input X4 Filter Time	no	0
05	Input X5 Filter Time	no	0
06	Input X6 Filter Time	no	0
07	Input X7 Filter Time	no	0
08	Input X8 Filter Time	no	0

0x260D Dynamic Open Winding Detection

This object enables the dynamic open winding detection function for the drive

     0 means disabled

     1 means enabled

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	0

0x260E Open Winding Detection Speed Limit

This object sets the maximum speed for dynamic open winding detection

The unit for this object is step/s.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
	UNSIGNED16	rw	no	-

0x260F Powerup Open Winding Detection

This object enables the power up open winding detection function for the drive

     0 means disabled

     1 means enabled

Object Type	Data Type	Access Type	PDO Mapping	Default Value
	UNSIGNED16	rw	no	-

0x2610 Motor Model

When the drive is connected with a Applied Motion Products standard step motor, this object can configure motor model number.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	0x0801

Value	Motor model number
0x1401	5014-842/042
0x1101	HT11-021
0x1102	HT11-020
0x1701	HT17-068/268
0x1702	HT17-071/271
0x1703	HT17-075/275
0x1704	HT17-278
0x2301	HT23-394/594
0x2302	HT23-398/598
0x2303	HT23-401/601
0x2304	HT23-603
0x2401	HT24-100
0x2402	HT24-105
0x2403	HT24-108
0x3401	HT34-474/504
0x3402	HT34-476/505
0x3403	HT34-478/506
0x3404	HT34-486/686
0x3405	HT34-487

0x2611 Load Inertia Ratio

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

Object Type	Data Type	Access Type	PDO Mapping	Default Value
Var	UNSIGNED16	rw	no	1

Value	Ratio
1	1
2	3
3	5
4	7
5	10

0x2612 Third Party Motor Parameters

Object Type	Data Type	Access Type	PDO Mapping	Default Value
	UNSIGNED16	ro	no	-

0x2100 User Registers

This object sets or reads back the value of user defined data registers (0~9, and some other characters). For more details about user defined data registers, please refer to Host Command Reference.

Object Type	Data Type	Access Type	Default Value
Array	UNSIGNED32	rw	0

Sub Index	Name	User Registers	PDO Mapping	Default Value
00	max sub-index			26
01	SubIndex 001	0	no	0
02	SubIndex 002	1	yes	0
03	SubIndex 003	2	yes	0
04	SubIndex 004	3	yes	0
05	SubIndex 005	4	yes	0
06	SubIndex 006	5	yes	0
07	SubIndex 007	6	yes	0
08	SubIndex 008	7	yes	0
09	SubIndex 009	8	yes	0
10	SubIndex 010	9	yes	0
11	SubIndex 011	:	yes	0
12	SubIndex 012	;	yes	0
13	SubIndex 013	<	yes	0
14	SubIndex 014	=	yes	0
15	SubIndex 015	>	yes	0
16	SubIndex 016	?	yes	0
17	SubIndex 017	@	yes	0
18	SubIndex 018	reserved	yes	0
19	SubIndex 019	reserved	yes	0
20	SubIndex 020	reserved	yes	0
21	SubIndex 021	[	yes	0
22	SubIndex 022	\	yes	0
23	SubIndex 023	]	yes	0
24	SubIndex 024	^	yes	0
25	SubIndex 025	_	yes	0
26	SubIndex 026	`	yes	0

Parameter Unit Scaling

Distance, Velocity, Acceleration and Deceleration

For STF EtherCAT drive, all the parameters for velocity, acceleration, deceleration and distance are based on steps.

The electronic gearing setting is fixed as 20000 steps/rev for STF EtherCAT drive..
Distance parameter value for 1 revolution is 20000.
Velocity parameter value for 10 rps is 200000.
Acceleration and Deceleration parameter value for 100rps/s is 2000000

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