maxon

Servo Controllers

ESCON2

Firmware Specification

escon.maxongroup.com

ESCON2 Servo Controllers Firmware Specification
CCMC | Edition 2024-12 | DocID rel12690

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1. About

1.1. About this document

1.1.1. Read this first

These instructions are intended for qualified technical personnel. Prior commencing with any activities…

- *you must carefully read and understand this manual and*
- *you must follow the instructions given therein.*

***The ESCON2** is considered as partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g) and **are intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment**.*

Therefore, you must not put the device into service,…

- *unless you have made completely sure that the other machinery fully complies with the EU directive's requirements!*
- *unless the other machinery fulfills all relevant health and safety aspects!*
- *unless all respective interfaces have been established and fulfill the herein stated requirements!*

1.1.2. Intended purpose

This document familiarizes you with the ESCON2 Servo Controllers Firmware Specification. It describes the tasks for safe and proper installation and commissioning. Follow the instructions:

- to avoid dangerous situations,
- to keep installation and/or commissioning time at a minimum,
- to increase the reliability and service life of the described equipment.

This document is part of a documentation set. It includes performance data, specifications, standards information, connection details, pin assignments, and wiring examples. The overview below shows the documentation hierarchy and how its parts are related:

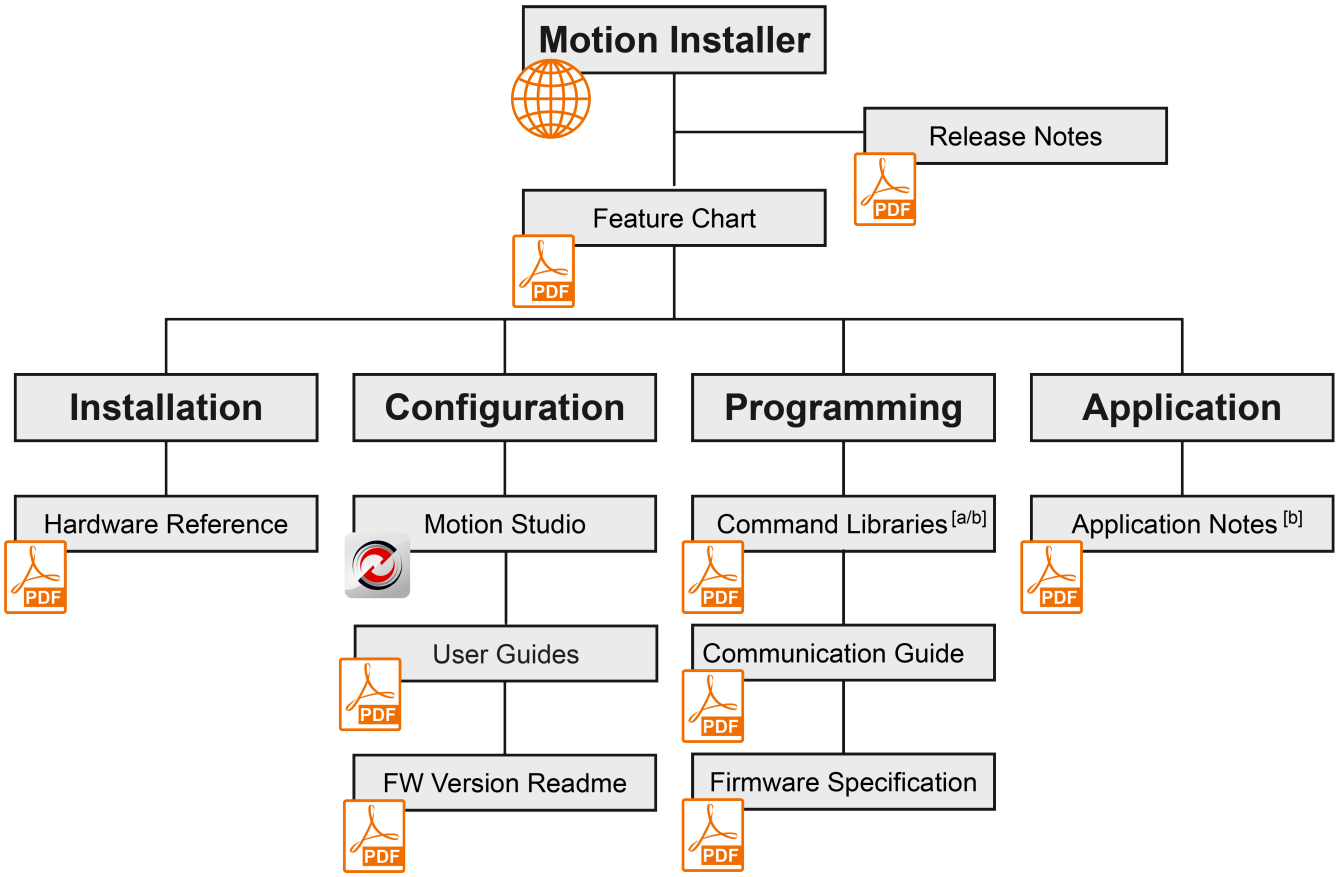

Figure 1. Documentation structure

[a] including software programming examples
[b] will be available with upcoming release

Find the latest edition of this document, along with additional documentation and software for ESCON2, at: http://escon.maxongroup.com

1.1.3. Target audience

This document is intended for trained and skilled personnel. It provides information on how to understand and perform the respective tasks and duties.

1.1.4. How to use

Throughout the document, the following notations and codes will be used.

Notation	Explanation
ESCON2	stands for “ESCON2 servo controller”
«Abcd»	Indicating a title or a name (such as of document, product, mode, etc.)
(n)	Referring to an item (such as an order number, list item, etc.)
*****	Referring to an internal value
→	Denotes “see”, “see also”, “take note of”, or “go to”

Table 1. Notations used

In later parts of this document, the following abbreviations and acronyms will be used:

Short	Description
CCW	Counterclockwise
CiA	CAN in Automation
CST	Cyclic Synchronous Torque Mode
CSV	Cyclic Synchronous Velocity Mode
CW	Clockwise
EDS	Electronic Data Sheet
GPIO	General Purpose Input/Output
IOCM	I/O Current Mode
IOVM	I/O Velocity Mode
NMT	Network Management
OBD	Object Dictionary
PDO	Process Data Object
PVM	Profile Velocity Mode
SCI	Serial Communication Interface
SDO	Service Data Object

Table 2. Abbreviations & acronyms used

1.1.5. Symbols and signs

In the course of the present document, the following symbols and signs will be used.

Type	Symbol	Meaning
Safety alert DANGER		Indicates an **imminent hazardous situation**. If not avoided, **it will result in death or serious injury.**
WARNING		Indicates a **potential hazardous situation**. If not avoided, it **can result in death or serious injury**.
CAUTION		Indicates a **probable hazardous situation** or calls the attention to unsafe practices. If not avoided, it **may result in injury**.
Prohibited action		Indicates a dangerous action. Hence, **you must not!**
Mandatory action		Indicates a mandatory action. Hence, **you must!**
Requirement, Note, Remark		Indicates an activity you must perform prior to continuing, or gives information on a particular point that must be observed.
Best practice		Indicates an advice or recommendation on the easiest and best way to further proceed.

Type	Symbol	Meaning
Material Damage		Indicates information particular to possible damage of the equipment.

Table 3. Symbols and signs

1.1.6. Trademarks and brand names

For easier legibility, registered brand names are listed below and will not be further tagged with their respective trademark. It must be understood that the brands (the below list is not necessarily conclusive) are protected by copyright and/or other intellectual property rights, even if their legal trademarks are omitted in the latter parts of this document.

Brand name	Trademark owner
Adobe® Reader®	© Adobe Systems Incorporated, USA-San Jose, CA

Table 4. Brand names and trademark owners

1.1.7. Sources for additional information

For further details and additional information, please refer to the resources listed below:

Ref.no.	Title / description
[1]	USB Implementers Forum: Universal Serial Bus Revision 2.0 Specification www.usb.org/developers/docs
[2]	CiA 301 V4.2: CANopen application layer and communication profile www.can-cia.org
[3]	CiA 302 V4.1: CANopen additional application layer functions www.can-cia.org
[4]	CiA 305 V3.0: Layer Setting Services (LSS) and protocols www.can-cia.org
[5]	CiA 306 V1.4: CANopen electronic data sheet specification www.can-cia.org
[6]	CiA 402 V5.0: CANopen device profile for drives and motion control www.can-cia.org
[7]	CiA 801 V1.0.1: Automatic bit-rate detection www.can-cia.org
[8]	Bosch's CAN Specification 2.0 www.can-cia.org
[9]	Konrad Etschberger: Controller Area Network ISBN 3-446-21776-2
[10]	maxon: ESCON2 Communication Guide http://escon.maxongroup.com
[11]	maxon: ESCON2 Hardware Reference http://escon.maxongroup.com
[12]	maxon: ESCON2 Firmware Version Readme http://escon.maxongroup.com
[13]	IEC 61158-x-12: Industrial communication networks – Fieldbus specifications (CPF 12)
[14]	IEC 61800-7 Ed 2.0: Adjustable speed electrical power drives systems (Profile type 1)
[15]	EN 5325-4 Industrial communications subsystem based on ISO 11898 (CAN) for controller device interfaces Part4: CANopen

Table 5. Sources for additional information

1.1.8. Copyright

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1.2. About the devices

The ESCON2 is a small-sized, powerful 4-quadrant PWM servo controller. Its high power density allows flexible use for brushed DC motors and brushless EC (BLDC) motors up to approximately 1’800 Watts with various feedback options, such as Hall sensors, incremental encoders in a multitude of drive applications. The device is specially designed to be commanded and controlled by analog and digital set values as well as a slave node in a CANopen network.
It also features extensive analog and digital I/O functionality. Latest technology, such as field-oriented control (FOC), acceleration and velocity feed forward, in combination with highest control cycle rates allow sophisticated, ease-of-use motion control.

You might also want to look at the ESCON2 video library. It includes video tutorials that show you how to get started with «Motion Studio» and show you tips and techniques on how to set up communication interfaces, among other things.

1.3. About the safety precautions

- Read and understand the note Read this first.
- Do not start any work unless you have the required skills (chapter Target Audience).
- Refer to chapter Symbols and signs to understand the symbols used.
- Follow all applicable health, safety, accident prevention, and environmental protection regulations for your country and work site.

Danger	
	***High voltage and/or electrical shock. Touching live wires causes death or serious injuries!*** • *Treat all power cables as live unless proven otherwise.* • *Ensure neither end of the cable is connected to live power.* • *Ensure the power source cannot be turned on while you work.* • *Follow lock-out/tag-out procedures.*

Requirements	
	• *Install all devices and components according to local regulations.* • *Electronic devices are not fail-safe. Ensure any machine has independent monitoring and safety equipment. If the machine breaks down, is operated incorrectly, or if the control unit or cables fail, etc. the drive system must return to and stay in a safe mode. Do not repair any components supplied by maxon.*

Electrostatic sensitive device (ESD)	
	• *Wear working cloth and use equipment in compliance with ESD protective measures.* • *Observe precautions for handling Electrostatic sensitive devices.* • *Handle the device with care.*

2. System overview

2.1. Device architecture

The ESCON2 communication interface follows the CiA CANopen specifications, EN 5325-4, IEC 61800-7 and ISO 11898 as referenced in Sources for additional information.

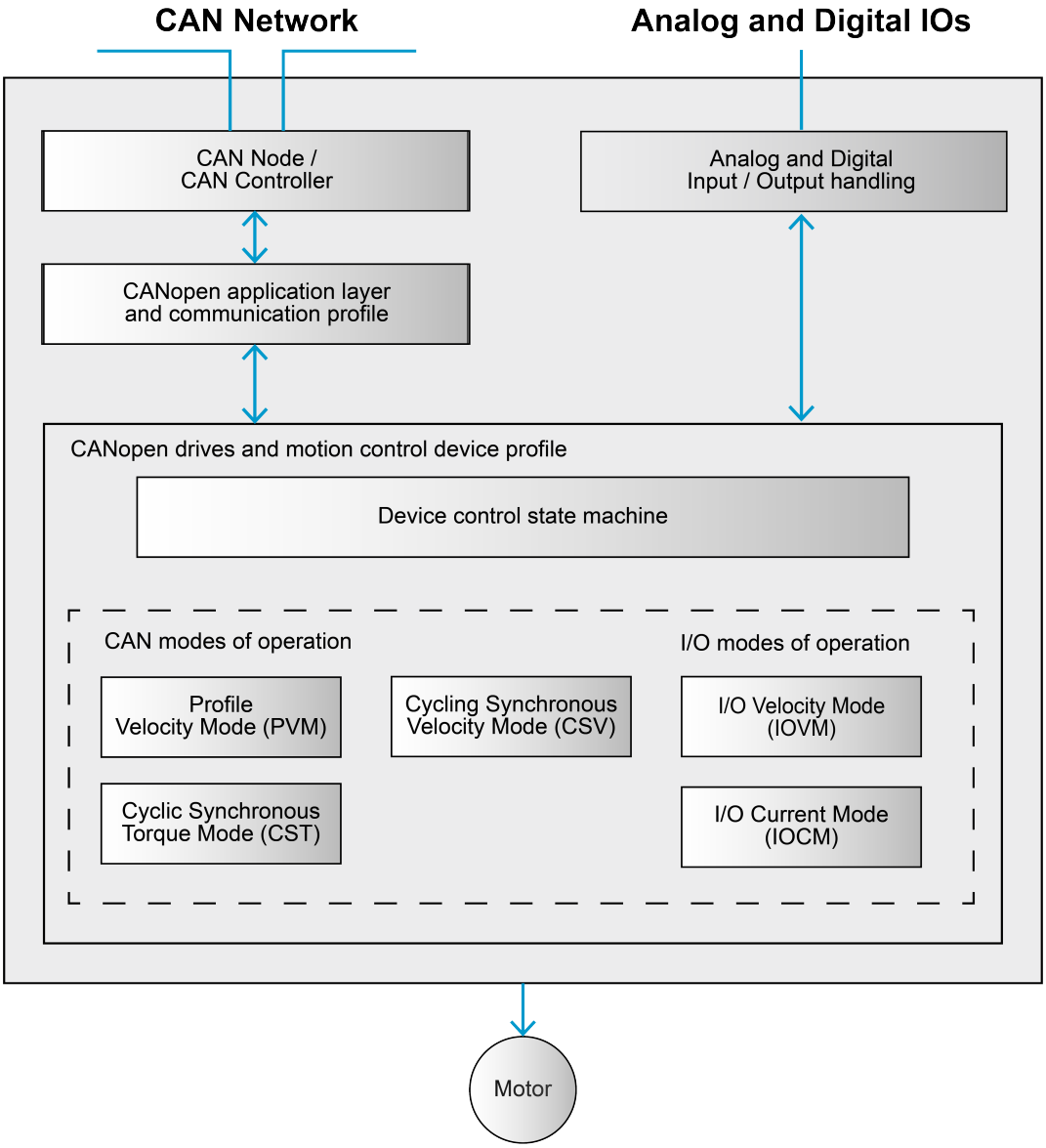

Figure 2. Communication architecture

DEVICE CONTROL

Starting and stopping of the drive and several mode-specific commands are executed by the state machine.

MODES OF OPERATION

The operating mode defines the behavior of the drive.

2.2. Device control

The state machine represents the device state as well as the device's potential control sequence. An object's state denotes a unique internal or external behavior. The commands that will be obeyed are also based on the device's status.

States may be changed using the Controlword and/or according to internal events. The actual state can be read using the Statusword. A new state transition must not be initiated before the previous one is completed, and the Statusword is changed accordingly.

Using the Controlword and/or in response to internal events, states can be modified. The Statusword can be used to read the current condition. Before the previous state transition is finished and the Statusword is updated appropriately, a new one cannot be started.

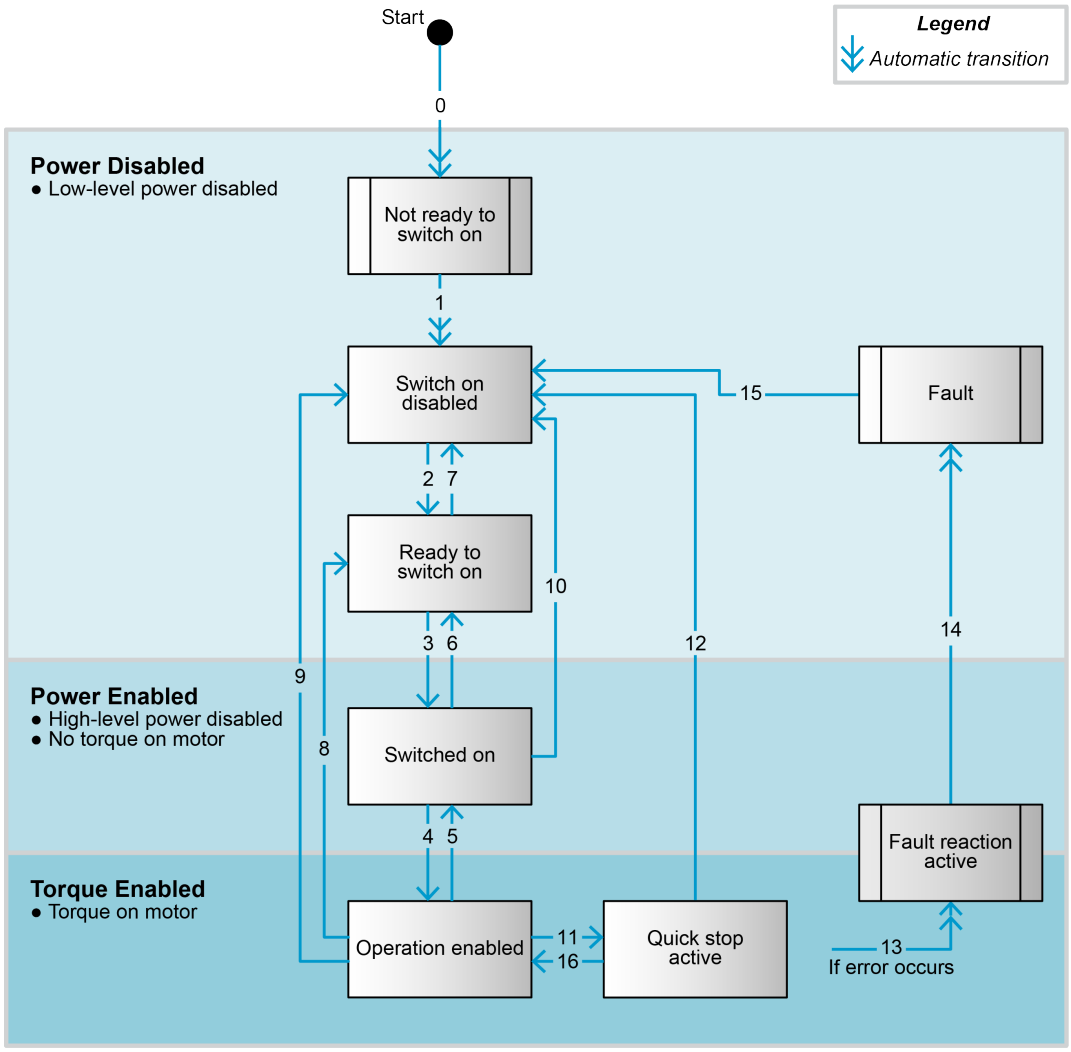

Figure 3. Device state machine

2.2.1. State of the drive

The following Statusword bits indicate the actual state of the drive.

State	Statusword [binary]	Description
Not ready to switch on	xxxx xxxx x00x 0000	Drive function and communication are disabled.
Switch on disabled	xxxx xxxx x10x 0000	Drive initialization is complete. Communication is enabled. Drive parameters may be changed. Drive function is disabled.
Ready to switch on	xxxx xxxx x01x 0001	Drive parameters may be changed. Drive function is disabled.
Switched on	xxxx xxxx x01x 0011	Drive function is disabled. Current offset calibration done.
Operation enabled	xxxx xxxx x01x 0111	No faults have been detected. Drive function is enabled and power is applied to the motor.

State	Statusword [binary]	Description
Quick stop active	xxxx xxxx x00x 0111	«Quick stop» function is being executed. Drive function is enabled and power is applied to the motor.
Fault reaction active	xxxx xxxx x00x 1111	A fault has occurred in the drive. Selected fault reaction is being executed. Also see Device errors.
Fault	xxxx xxxx x00x 1000	A fault has occurred in the drive. Drive parameters may have changed. Drive function is disabled. Also see Device errors.

Table 6. Device state bits

2.2.2. State transitions

State transitions are caused by internal events in the drive or by commands from the host via the Controlword.

Note:

If a command is received that causes a change of state, this command will be processed completely and the new state attained before the next command can be processed.

Transition	Event	Action
0	Reset	Initialize drive
1	Drive has initialized successfully	Activate communication
2	«Shutdown» command received	-
3	«Switched on» command received	Initialize current sensor. Current offset calibration. Motor must stand still to allow a precise calibration.
4	«Enable operation» command received	Enable the driving function, including the current controller and any superordinate controllers that may be required.
5	«Disable operation» command received	Stop movement according to Disable operation option code. Disable drive function.
6	«Shutdown» command received	Disable power section
7	«Quick stop» or «Disable voltage» command received	-
8	«Shutdown» command received	Stop movement according to Shutdown option code. Disable drive function and power section.
9	«Disable voltage» command received	Disable drive function and power section.
10	«Quick stop» or «Disable voltage» command received	-
11	«Quick stop» command received	Stop movement according to «Quick stop option code»
12	«Disable voltage» command received	Disable drive function and power section
13	A fault has occurred	Start fault reaction
14	The fault reaction is completed	Disable drive function and power section
15	«Fault reset» command received	Reset fault condition if no fault is present
16	«Enable operation» command received	-

Table 7. Device state transitions

2.2.3. Device control commands

Axis control commands are triggered by the following bit patterns in the Controlword.

Note:

If a command is received that causes a change of state, this command will be processed completely and the new state attained before the next command can be processed.

Command	Controlword LowByte [binary]	State transition
Shutdown	0xxx x110	2, 6, 8
Switch on	0xxx x111	3
Switch on & Enable operation	0xxx 1111	3, 4 (*1)
Disable voltage	0xxx xx0x	7, 9, 10, 12
Quick stop	0xxx x01x	11
Disable operation	0xxx 0111	5
Enable operation	0xxx 1111	4, 16
Fault reset	0xxx xxxx → 1xxx xxxx	14, 15
Clear warning	0xxx xxxx → 1xxx xxxx	N/A (*2)

Table 8. Axis control commands

(*1) Automatic transition to state «Operation enabled» after execution of command «Switch on»
(*2) Warning can be cleared in any state and does not lead to state transition

2.2.4. Device LED Status

The device provides a red and a green LED to display the actual operation state and possible errors of the device:

- LED green shows the operation state
- LED red indicates errors

LED Green	LED Red	Warning / Error	Description
Slow	OFF	No warning/error active.	Power stage is disabled. The ESCON2 is in status - Switch on disabled - Ready to switch on - Switched on
Slow	Slow	At least one warning is active.	
ON	OFF	No warning/error active.	Power stage is enabled. The ESCON2 is in status - Operation enabled - Quick stop active
ON	Slow	At least one warning is active.	
ON	ON	At least one error has occurred.	Power stage is enabled. The ESCON2 is in status - Fault reaction active
OFF	ON	At least one error has occurred.	Power stage is disabled. The ESCON2 is in status - Fault
Flash	ON	n/a	Firmware update in progress or invalid application(*1)
Flicker		n/a	Device identification(*2)

LED Green	LED Red	Warning / Error	Description
Flash = LED is flashing (0.9s OFF, 0.1s ON) Slow = LED is slowly blinking (0.5s OFF, 0.5s ON) ON = LED is on OFF = LED is off Flicker = LEDs flicker alternately (0.07s OFF, 0.07s ON) (*1) Normally, this LED status is visible for a few seconds only, during a firmware download. If this state is active for a longer time or even after a power cycle, it means that no valid application is loaded. → Firmware download is needed. (*2) This LED blink pattern is activated when the device is in the CAN-LSS configuration state or by Motion Studio device identification feature.			

Table 9. LED system state indicator

2.3. System units

The user-defined units for this device are as follows:

- Velocity units (SI unit velocity)
- Acceleration units (SI unit acceleration)

The units are used for all objects that support user-defined units. They are specified by SI unit objects. Objects with factor group-independent values have fixed units specified by the object. The coding of user-defined units and prefixes is structured as described in User-defined units - Parameter structure.

Bit 31…24	Bit 24…16	Bit 15…8	Bit 7…0
Prefix	Numerator	Denominator	Reserved(0)

Table 10. User-defined units - Parameter structure

2.3.1. Si units

Description	Name	Symbol	Notation index
Dimensionless	-	-	0x00
Length	Meter	m	0x01
Mass	Kilogram	kg	0x02
Time	Second	s	0x03
Electric current	Ampere	A	0x04
Time	Minute	min	0x47
Square second	Square second	s^2	0x57

Table 11. SI units - Notation index

2.3.2. CiA 402 Application profile-specific units

Description	Name	Symbol	Notation Index
Revolutions	revolutions	rev	0xB4
Increments	increments	inc	0xB5
Steps	steps	steps	0xAC
Velocity (manufacturer-specific)	revolutions/minute	rpm	0xC0

Table 12. CiA 402 Application profile-specific units - Notation index

2.3.3. Unit prefixes

Prefix	Factor	Symbol	Notation index
Mega	10^{6}	M	0x06
Kilo	10^{3}	k	0x03
Hecta	10^{2}	h	0x02
Deca	10^{1}	da	0x01
-	10^{0}	-	0x00
Deci	10^{-1}	d	0xFF
Centi	10^{-2}	c	0xFE
Milli	10^{-3}	m	0xFD
—	10^{-4}	—	0xFC
—	10^{-5}	—	0xFB
Micro	10^{-6}	µ	0xFA

Table 13. Unit prefixes - Notation index

3. Operating modes

3.1. Operating mode selection guide

The device behavior depends on the currently activated mode of operation.

- Choose desired mode Overview
- Select mode using Modes of operation
- Read currently active mode from Modes of operation display

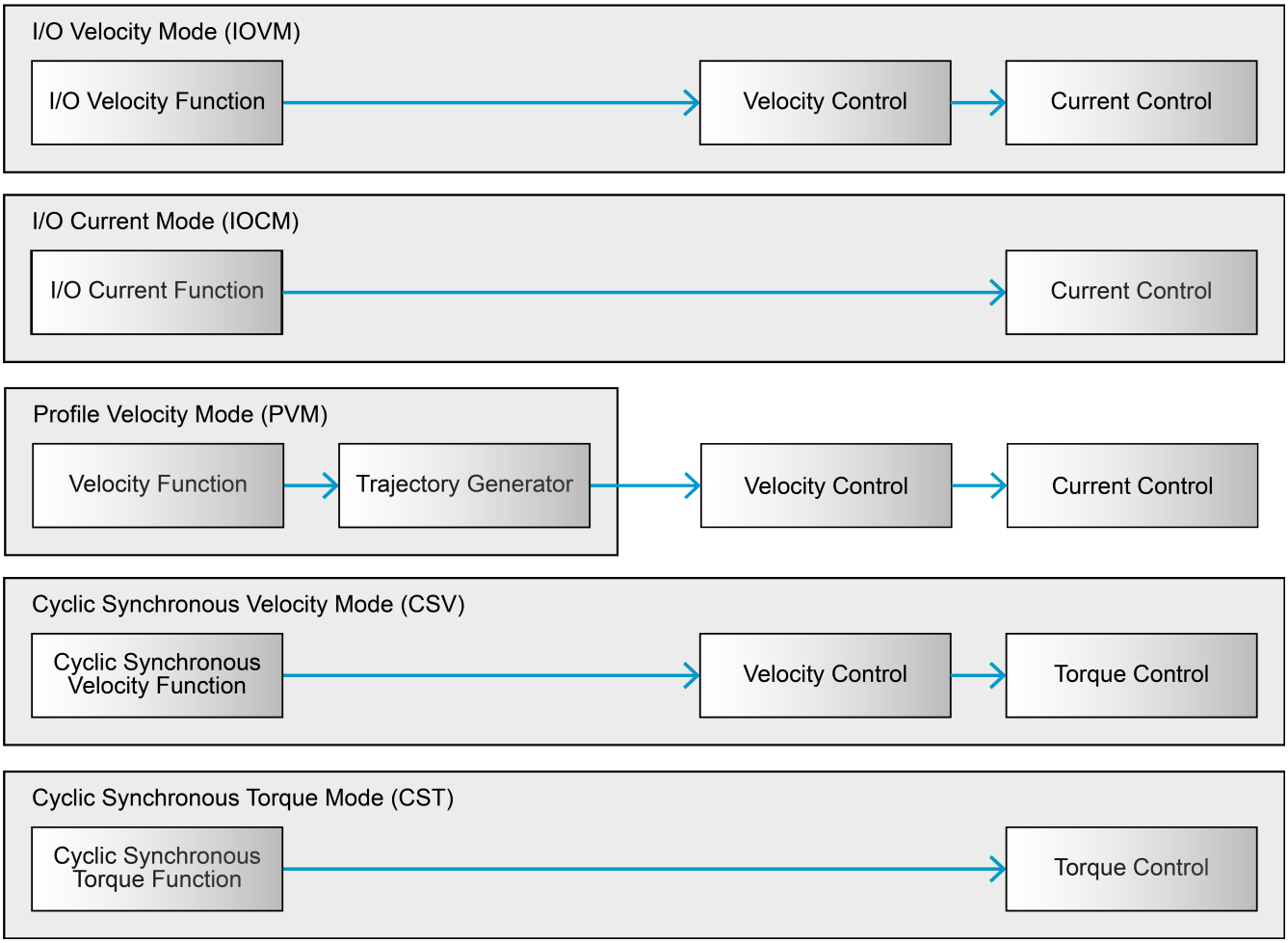

Figure 4. Functional architecture

3.2. Overview

I/O Velocity Mode (IOVM)

An analog input provides a target velocity to the drive, which then performs velocity control and current control. For details see I/O Velocity Mode (IOVM)

I/O Current Mode (IOCM)

An analog input provides a target current to the drive. For details see I/O Current Mode (IOCM)

Profile Velocity Mode (PVM)

Controls the drive's velocity according to the target velocity set by a master system. It supplies limit functions and trajectory generation. For details see Profile Velocity Mode (PVM)

Cyclic Synchronous Velocity Mode (CSV)

With Cyclic Synchronous Velocity Mode, the trajectory generator is located in the control device (not in the drive). It provides a target velocity to the drive in cyclic synchronous manner, thus the drive performing velocity control and torque control. For details see Cyclic Synchronous Velocity Mode (CSV)

Cyclic Synchronous Torque Mode (CST)

With Cyclic Synchronous Torque Mode, the trajectory generator is located in the control device (not in the drive). In cyclic synchronous manner, it provides a target torque to the drive, which then performs torque control. For details see Cyclic Synchronous Torque Mode (CST)

3.3. Profile Velocity Mode (PVM)

The Profile Velocity Mode includes a velocity trajectory generator and a Velocity control function.

Note:

Items marked with an asterisk (*) refer to internal values.

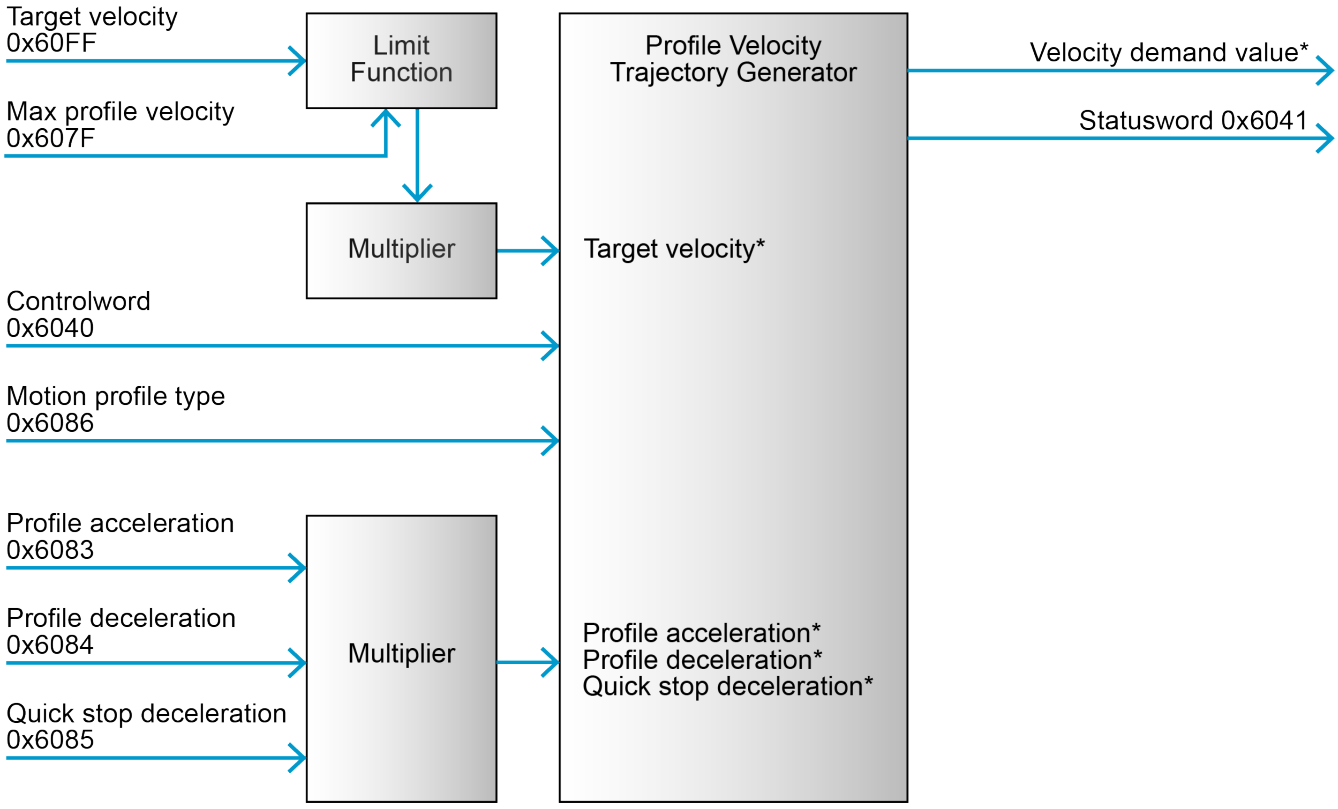

Figure 5. Profile Velocity Mode - block diagram

3.3.1. Profile velocity trajectory generator

The trajectory generator supports the following motion profiles.

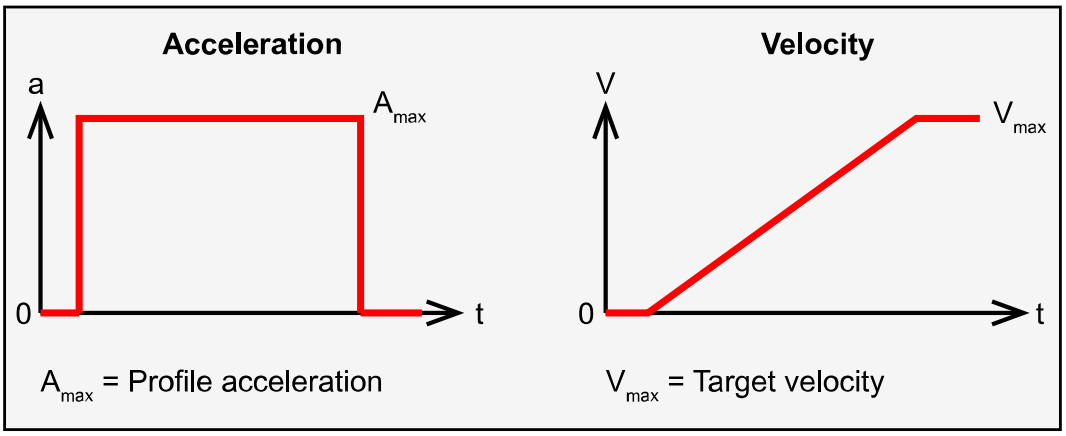

Figure 6. Profile velocity trajectory - linear ramp (trapezoidal profile)

3.3.2. How to use PVM

3.3.2.1. Configuration parameters

Parameter	Index	Description
Max profile velocity	0x607F	Defines the maximum permitted speed.
Max motor speed	0x6080	Indicates the configured maximum permitted speed for the motor. It serves as protection of the motor and is taken from the motor data sheet.
Quick stop deceleration	0x6085	Defines the deceleration ramp during a «Quick stop».
Max acceleration	0x60C5	Defines the maximum allowed acceleration and deceleration.

Table 14. Profile Velocity Mode - Configuration parameters

3.3.2.2. Commanding parameters

Parameter	Index	Description
Controlword	0x6040	The mode will be controlled by a write access to the controlword's mode-dependent bits. A new target velocity is not assumed before the controlword is written.
Target velocity	0x60FF	The speed that the drive is supposed to reach.
Profile acceleration	0x6083	Defines the acceleration ramp during a movement.
Profile deceleration	0x6084	Defines the deceleration ramp during a movement.
Motion profile type	0x6086	Selects the type of motion profile used for the movement: 0 = linear ramp (trapezoidal profile).

Table 15. Profile Velocity Mode - Commanding parameters

3.3.2.3. Controlword

Bit 15…9	Bit 8	Bit 7	Bit 6…4	Bit 3…0
Controlword bits	Halt	Controlword bits	Reserved	Controlword bits

Table 16. Profile Velocity Mode - Controlword

Name	Value	Description
Halt	0	Execute or continue motion
	1	Stop axis

Table 17. Profile Velocity Mode - Controlword bits

3.3.2.4. Output parameters

Parameter	Index	Description
Statusword	0x6041	Mode state can be observed by the statusword bits.
Velocity demand value	0x606B	The output of the trajectory generator. It is used as input for the Velocity control function.

Table 18. Profile Velocity Mode - Output parameters

3.3.2.5. Statusword (Profile Velocity Mode - Specific bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11 [1]	Bit 10	Bit 9…0
Statusword bits	Not used	Speed	Speed is limited	Target reached	Statusword bits

[1] the velocity-based Limits also apply for bit 11.

Table 19. Profile Velocity Mode - Statusword

Name	Value	Description
Target reached	0	Halt = 0: Target velocity not (yet) reached Halt = 1: Axis is decelerating
	1	Halt = 0: Target velocity reached Halt = 1: Axis has velocity "0" (zero)
Speed	0	Speed is not equal to "0" (zero)
	1	Speed is equal to "0" (zero)
Speed is limited	0	Speed is not limited
	1	Speed is limited to Max profile velocity

Table 20. Profile Velocity Mode - Statusword bits

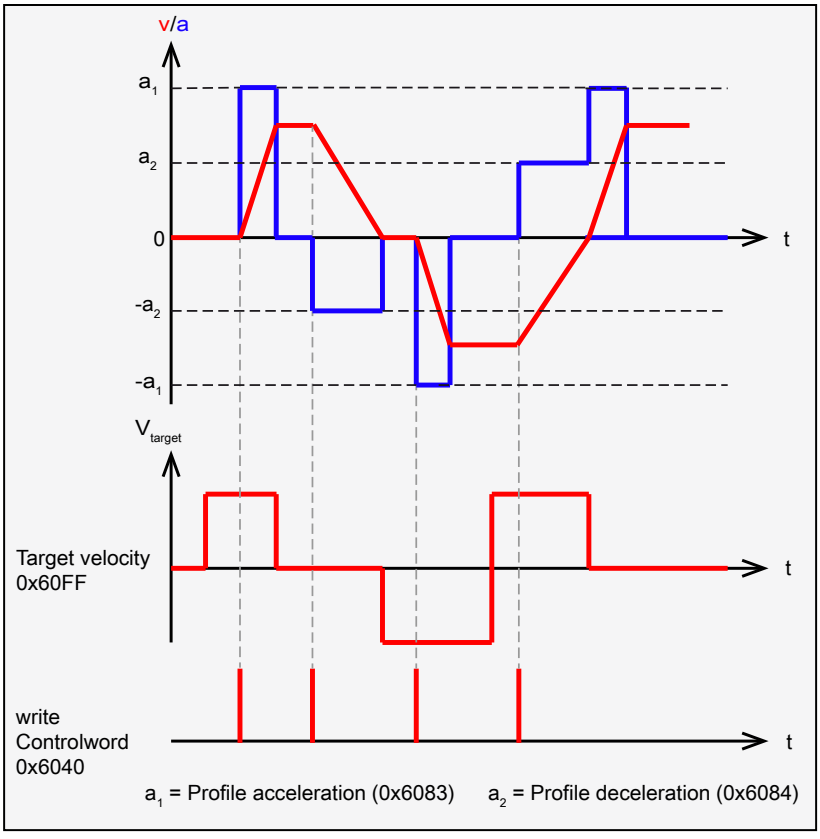

Figure 7. Profile Velocity Trajectory - Set value and acceleration behaviour (example)

3.4. Cyclic Synchronous Velocity Mode (CSV)

In Cyclic Synchronous Velocity Mode, the trajectory generator is located in the control device (not in the drive). It provides Target velocity to the drive in a cyclic synchronous manner, with the drive performing velocity control and torque control.

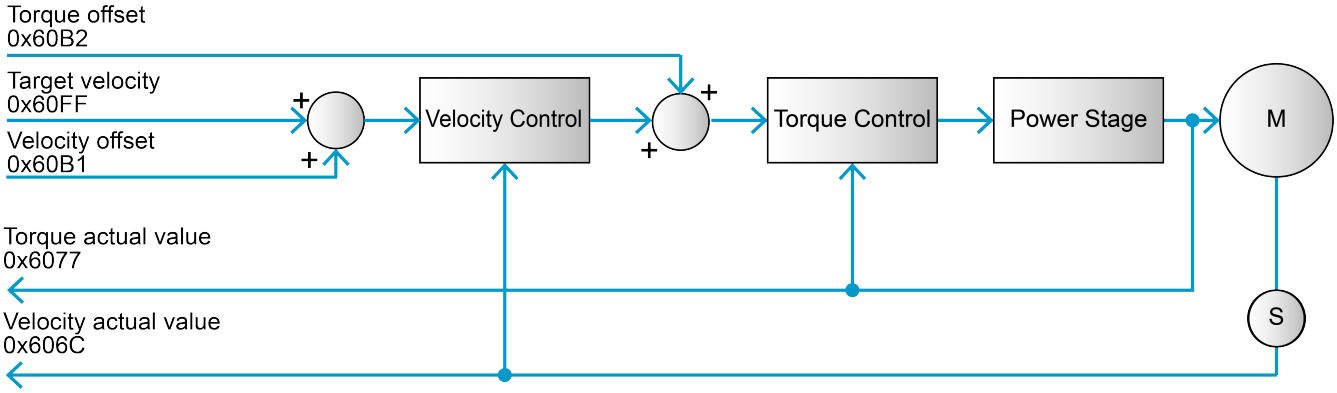

Figure 8. Cyclic Synchronous Velocity Mode - overview

Cyclic Synchronous Velocity Mode is based on the Velocity control function. The input is Target velocity. Optionally, additive values from Velocity offset and Torque offset may be provided by the control system to allow a second source for velocity and/or torque feedforward.

A linear interpolation, based on Interpolation time period value, is executed between two velocity values. This interpolation is active only for synchronous PDO communication.
The acceleration feedforward is active if the gain Velocity controller FF acceleration gain is not zero.

The input Motor data is used to define limits for velocity and current values. Actual values for velocity and torque are used as outputs to the control device

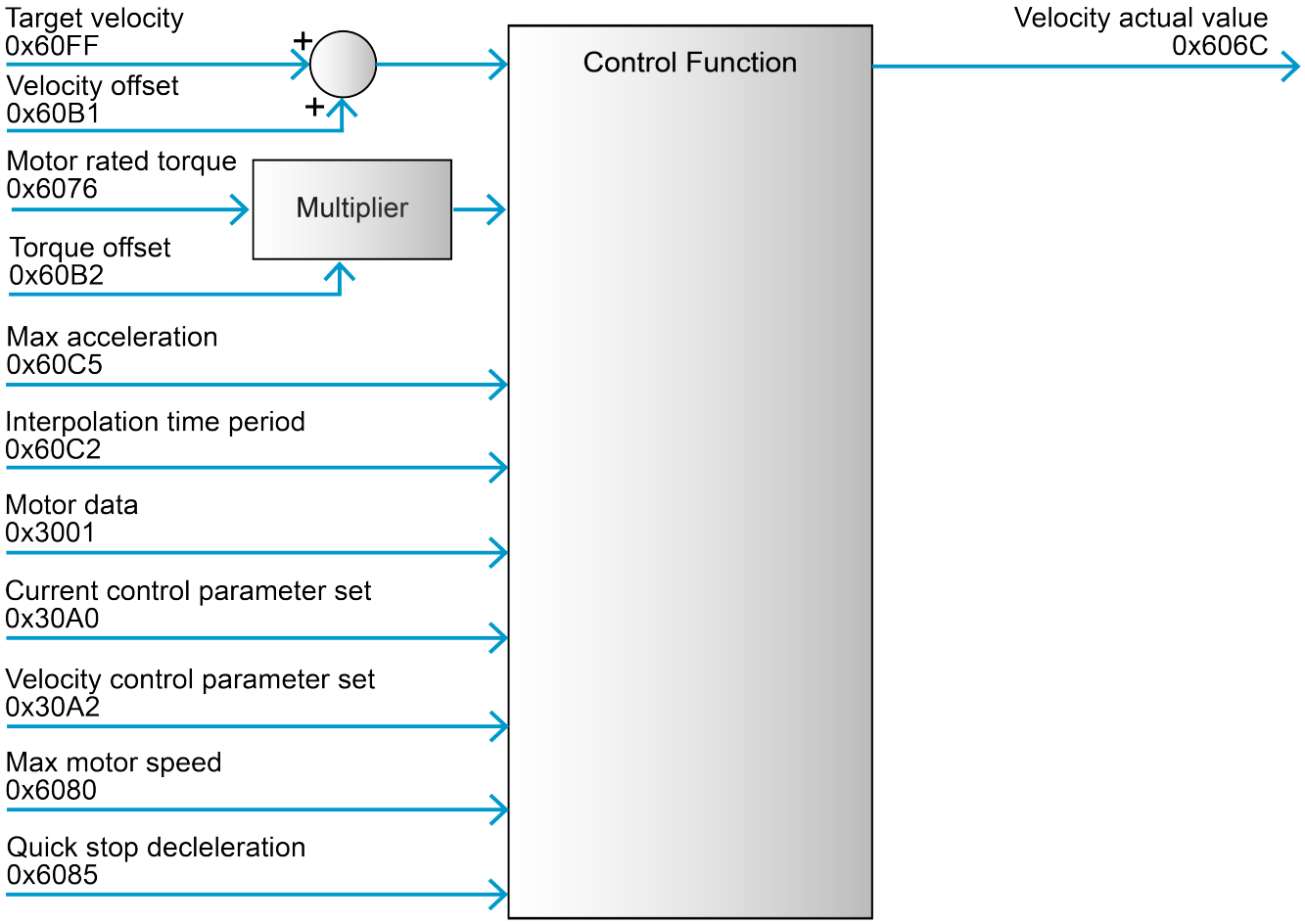

Figure 9. Cyclic Synchronous Velocity Mode - Block diagram

3.4.1. How to use CSV

3.4.1.1. Configuration parameters

Parameter	Index	Description
Nominal current	0x3001-01	The maximum permissible continuous current of the motor.
Torque constant	0x3001-05	The torque constant of the motor.
Current control parameter set	0x30A0	Configuration of the current controller gains.
Velocity control parameter set	0x30A2	Configuration of the velocity controller gains.
Motor rated torque	0x6076	Holds the value to which all torque objects are related to.
Max motor speed	0x6080	Indicates the configured maximum allowed speed for the motor. It serves as protection of the motor and is taken from the motor data sheet.
Quick stop deceleration	0x6085	Defines the deceleration for the quick-stop ramp (for stopping only).
Interpolation time period	0x60C2	Defines the interpolation time interval.

Table 21. Cyclic Synchronous Velocity Mode - Configuration parameters

3.4.1.2. Commanding parameters

Parameter	Index	Description
Target velocity	0x60FF	Velocity input value for the velocity controller.
Velocity offset	0x60B1	Optional velocity feed forward input.

Parameter	Index	Description
Torque offset	0x60B2	Optional torque feed forward input.

Table 22. Cyclic Synchronous Velocity Mode - Commanding parameters

3.4.1.3. Controlword

Cyclic Synchronous Velocity Mode does not use mode-specific controlword bits.

3.4.1.4. Output Parameters

Parameter	Index	Description
Torque actual value	0x6077	Actual motor torque value
Velocity actual value	0x606C	Actual velocity value

Table 23. Cyclic Synchronous Velocity Mode - Output parameters

3.4.1.5. Statusword (Cyclic Synchronous Velocity Mode - Specific bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9…0
Statusword bits	Reserved	drive follows command value	Limits	Reserved	Statusword bits

Table 24. Cyclic Synchronous Velocity Mode - Statusword

Name	Value	Description
drive follows command value	0	Drive does not follow the target value.
	1	Drive is in state operation enabled and follows the target and set values of the control device.

Table 25. Cyclic Synchronous Velocity Mode - Statusword bits

3.5. Cyclic Synchronous Torque Mode (CST)

In Cyclic Synchronous Torque Mode, the trajectory generator is located in the control device (not in the drive). It provides a Target torque to the drive in a cyclic synchronous manner, with the drive performing torque control.

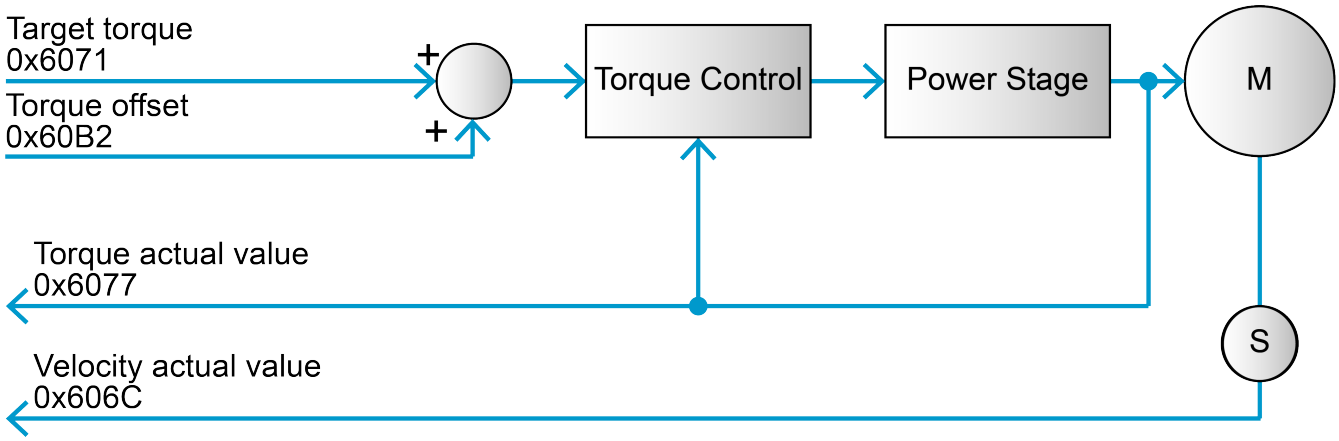

Figure 10. Cyclic Synchronous Torque Mode - overview

Cyclic Synchronous Torque Mode is based on the current control function. The inputs are Target torque and (optionally) Torque offset. The input Motor data is used to define limits for velocity and current values. Actual values for velocity and torque are used as outputs to the control device.

Note:
Speed limitation is only active if a main sensor is configured in Control structure. In this case, the Velocity control parameter set must be configured/tuned even though only torque control is used for regulation.

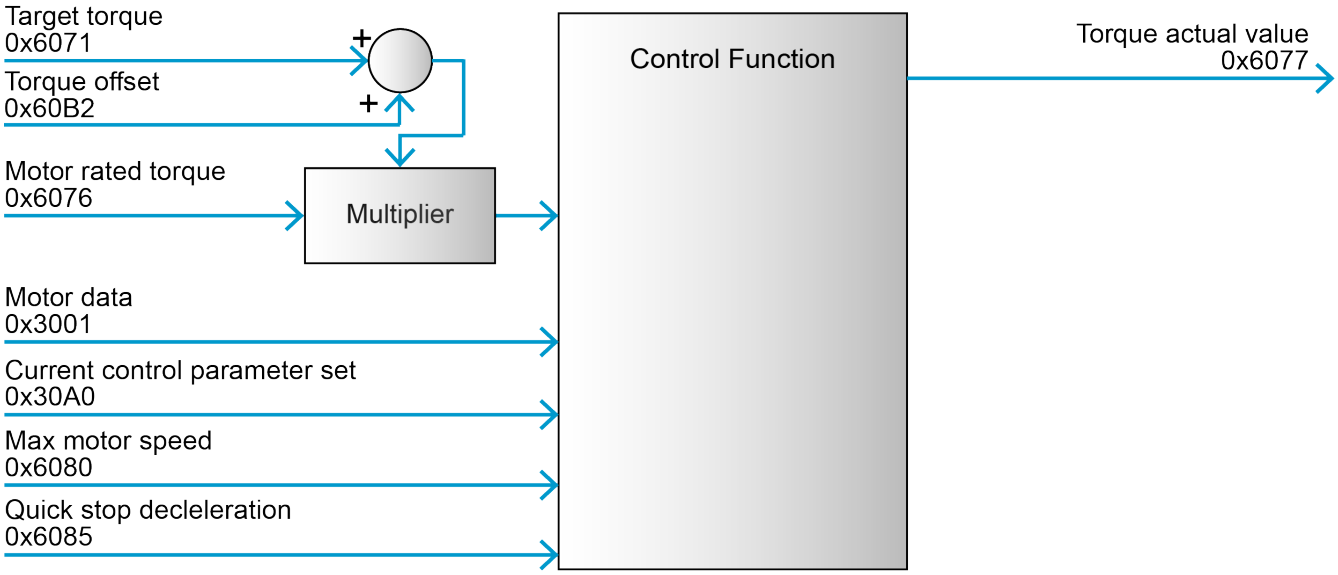

Figure 11. Cyclic Synchronous Torque Mode - Block diagram

3.5.1. How to use CST

3.5.1.1. Configuration parameters

Parameter	Index	Description
Nominal current	0x3001-01	The maximum permissible continuous current of the motor.
Torque constant	0x3001-05	Defines the torque constant of the motor.
Current control parameter set	0x30A0	Configuration of the current controller gains.
Velocity control parameter set	0x30A2	Configuration of the velocity controller gains. This is necessary in order to optimally limit the velocity to max motor speed.
Max motor speed	0x6080	Indicates the configured maximum allowed speed for the motor. It serves as protection of the motor and is taken from the motor data sheet.
Motor rated torque	0x6076	Holds the value to which all torque objects are related to.
Quick stop deceleration	0x6085	Defines the deceleration for the quick stop ramp (for stopping only).

Table 26. Cyclic Synchronous Torque Mode - Configuration parameters

3.5.1.2. Commanding parameters

Parameter	Index	Description
Target torque	0x6071	Torque input value for the torque controller.
Torque offset	0x60B2	Optional additive torque which is added to the target torque value.

Table 27. Cyclic Synchronous Torque Mode - Commanding parameters

3.5.1.3. Controlword

Cyclic Synchronous Torque Mode does not use mode-specific controlword bits.

3.5.1.4. Output parameters

Parameter	Index	Description
Torque actual value	0x6077	Actual motor torque value
Velocity actual value	0x606C	Actual velocity value

Table 28. Cyclic Synchronous Torque Mode - Output parameters

3.5.1.5. Statusword (Cyclic Synchronous Torque Mode - Specific bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9…0
Statusword bits	Reserved	drive follows command value	Limits	Reserved	Statusword bits

Table 29. Cyclic Synchronous Torque Mode - Statusword

Name	Value	Description
drive follows command value	0	Drive does not follow the target value
	1	Drive is in state operation enabled and follows the target and set values of the control device

Table 30. Cyclic Synchronous Torque Mode - Statusword bits

3.6. I/O Velocity Mode (IOVM)

The «I/O Velocity Mode» is used for velocity control in correspondence with I/O commanding. The configured input provides a set value velocity to the drive, which then performs velocity control with underlying current control. See Configuration of digital inputs and Configuration of analog inputs for further information.

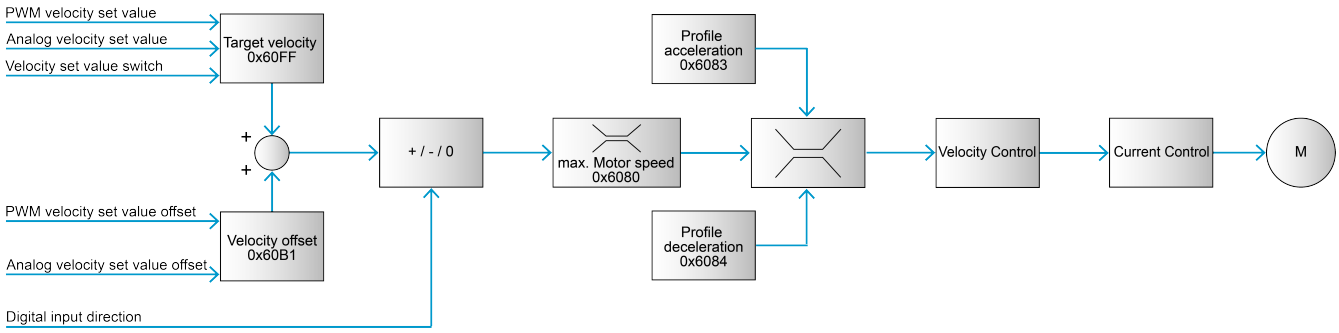

Figure 12. I/O Velocity Mode - overview

The I/O Velocity Mode is based on Velocity control function. Target velocity is used as the set value while Motor data and Max motor speed are used to determine current and velocity limitations. Furthermore, Profile acceleration and Profile deceleration are used to limit the rate of change for the velocity controller input.

3.6.1. How to use IOVM

3.6.1.1. Configuration parameters

Parameter	Index	Description
Nominal current	0x3001-01	The maximum permissible continuous current of the motor.
Current control parameter set	0x30A0	Configuration of the current controller gains.
Velocity control parameter set	0x30A2	Configuration of the velocity controller gains. The Velocity controller FF acceleration gain is not active in IOVM, however.
Max motor speed	0x6080	Indicates the configured maximum allowed speed for the motor. It serves as protection of the motor and is taken from the motor data sheet.

Parameter	Index	Description
Quick stop deceleration	0x6085	Defines the deceleration for the quick-stop ramp (for stopping only).
Max acceleration	0x60C5	Defines the maximum allowed acceleration and deceleration.

Table 31. I/O Velocity Mode - Configuration parameters

3.6.1.2. Commanding parameters

Parameter	Index	Description
Target velocity	0x60FF	Velocity input value for the velocity controller.
Velocity offset	0x60B1	Optional velocity feed forward input.
Profile acceleration	0x6083	Defines the acceleration ramp during a movement.
Profile deceleration	0x6084	Defines the deceleration ramp during a movement.

Table 32. I/O Velocity Mode - Commanding parameters

3.6.1.3. Controlword

I/O Velocity Mode does not use mode-specific controlword bits.

3.6.1.4. Output parameters

Parameter	Index	Description
Velocity actual value	0x606C	Actual velocity value
Current actual value	0x30D1-02	Actual current value

Table 33. I/O Velocity Mode - Output parameters

3.6.1.5. Statusword (I/O Velocity Mode - Specific Bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9…0
Statusword bits	Reserved	drive follows command value	Limits	Reserved	Statusword bits

Table 34. I/O Velocity Mode - Statusword

Name	Value	Description
drive follows command value	0	Drive does not follow the target value
	1	Drive is in state operation enabled and follows the target and set values of the control device

Table 35. I/O Velocity Mode - Statusword bits

3.7. I/O Current Mode (IOCM)

The «I/O Current Mode» is used for current control in correspondence with I/O commanding. The configured input provides a current set value to the drive, which then performs current control. See Configuration of digital inputs and Configuration of analog inputs for further information.

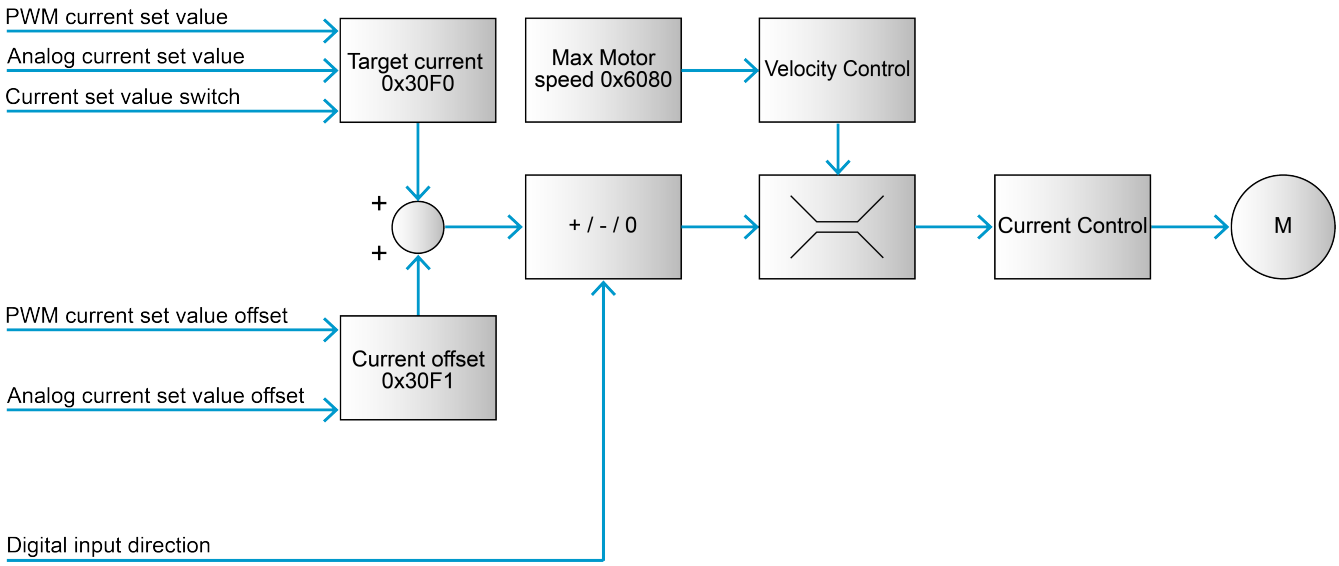

Figure 13. I/O Current Mode - Overview

I/O Current Mode is based on the current control function. Inputs are Target current and Current offset. The Motor data is used to define limitations for velocity and current values.

Note:	
	Speed limitation is only active if a main sensor is configured in Control structure. In this case, the Velocity control parameter set must be configured/tuned even though only torque control is used for regulation.

3.7.1. How to use IOCM

3.7.1.1. Configuration parameters

Parameter	Index	Description
Nominal current	0x3001-01	The maximum permissible continuous current of the motor.
Current control parameter set	0x30A0	Configuration of the current controller gains.
Velocity control parameter set	0x30A2	Configuration of the velocity controller gains. This is necessary in order to optimally limit the velocity to max motor speed.
Max motor speed	0x6080	Indicates the configured maximum allowed speed for the motor. It serves as protection of the motor and is taken from the motor data sheet.
Quick stop deceleration	0x6085	Defines the deceleration for the quick-stop ramp (for stopping only).

Table 36. I/O Current Mode - Configuration parameters

3.7.1.2. Commanding parameters

Parameter	Index	Description
Target current	0x30F0	Current input value for the current controller.
Current offset	0x30F1	Optional additive current which is added to the target current value.

Table 37. I/O Current Mode - Commanding parameters

3.7.1.3. Controlword

I/O Current Mode does not use mode-specific controlword bits.

3.7.1.4. Output parameters

Parameter	Index	Description
Current actual values	0x30D1	Current actual values
Velocity actual value	0x606C	Actual velocity value

Table 38. I/O Current Mode - Output parameters

3.7.1.5. Statusword (I/O Current Mode - Specific bits)

Bit 15, 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9…0
Statusword bits	Reserved	drive follows command value	Limits	Reserved	Statusword bits

Table 39. I/O Current Mode - Statusword

Name	Value	Description
drive follows command value	0	Drive does not follow the target value
	1	Drive is in state operation enabled and follows the target and set values of the control device

Table 40. I/O Current Mode - Statusword bits

3.8. Velocity control function

Used for velocity-based operating modes, such as Profile Velocity Mode (PVM), I/O Velocity Mode (IOVM) and Cyclic Synchronous Velocity Mode (CSV).

The control loop uses the velocity demand value and the velocity actual value as input parameters. The behavior of the control can be influenced by externally applied control parameters. The output of the controller is a current demand value, which serves as input for the current controller.

Note:	
	Items marked with an asterisk (*) refer to internal values.

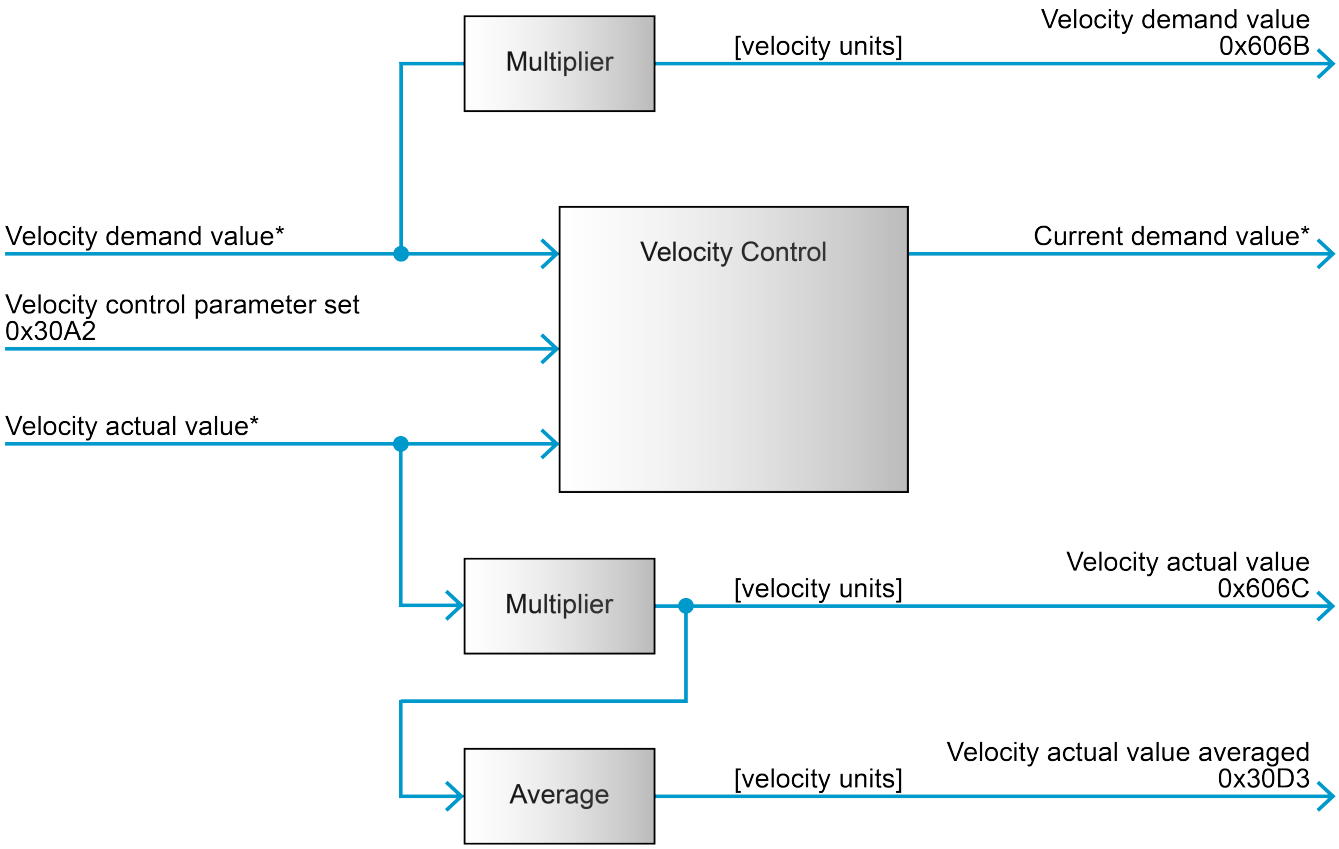

Figure 14. Velocity control function - Block diagram

3.8.1. How to use velocity control function

3.8.1.1. Configuration parameters

Parameter	Index	Description
Velocity control parameter set	0x30A2	Configuration of the velocity controller gains

Table 41. Velocity control function - Configuration parameters

3.8.1.2. Commanding parameters

There are no commanding parameters. The velocity control function is directly commanded by velocity-based operating modes.

3.8.1.3. Output parameters

Parameter	Index	Description
Velocity demand value	0x606B	The operation mode's output. It is used as input for the velocity control function. Generally, the value is the output of the trajectory generator.
Velocity actual value	0x606C	The actual velocity value
Velocity actual value averaged	0x30D3-01	The averaged actual velocity value

Table 42. Velocity control function - Output parameters

3.8.2. Limits

This limits are applicable for all velocity-based operating modes.

Depending on the configuration, the velocity commanded may not be reached due to limits. When this occurs, bit

11 of the Statusword will be set. This state can also be mapped to an output pin through a Digital outputs functionality.

Limitation	Description	Effect
Output current limit	The velocity set value cannot be reached because the required current would exceed the current allowed by the object Output current limit.	The Current demand value will be limited to Output current limit.
Thermal protection motor	The velocity set value cannot be reached because an internal I2t model estimating the motor temperature is limiting the Current demand value, in order to prevent the motor from overheating.	The model limits the Current demand value to a maximum of between Nominal current and Output current limit. Related Objects: Nominal current, Thermal time constant winding, I2t level motor.
Thermal protection power stage	The velocity set value cannot be reached because the power stage temperature (measured and/or I2t model) is limiting the Current demand value, in order to prevent the power stage from overheating.	The Current demand value is limited, in the worst case to 0. Related Objects: I2t level power stage, Temperature power stage, Max temperature power stage.
Max motor speed	The velocity set value cannot be reached if it is larger than Max motor speed or Max profile velocity.	The Velocity demand value is limited to a maximum value of Max motor speed.
Power stage max output level	The velocity set value cannot be reached because the Power stage output level actual value has reached the Power stage max output level, indicating that the required voltage cannot be reached. This may be due to the Power supply voltage being too low.	The Current actual value will be lower than the Current demand value.

Table 43. Velocity Based Operation Modes - Limits

3.9. Current control function

All operating modes are based on the current control function. The Current demand value is received from a superordinate motion control function.

Note:	
	Items marked with an asterisk (*) refer to internal values.

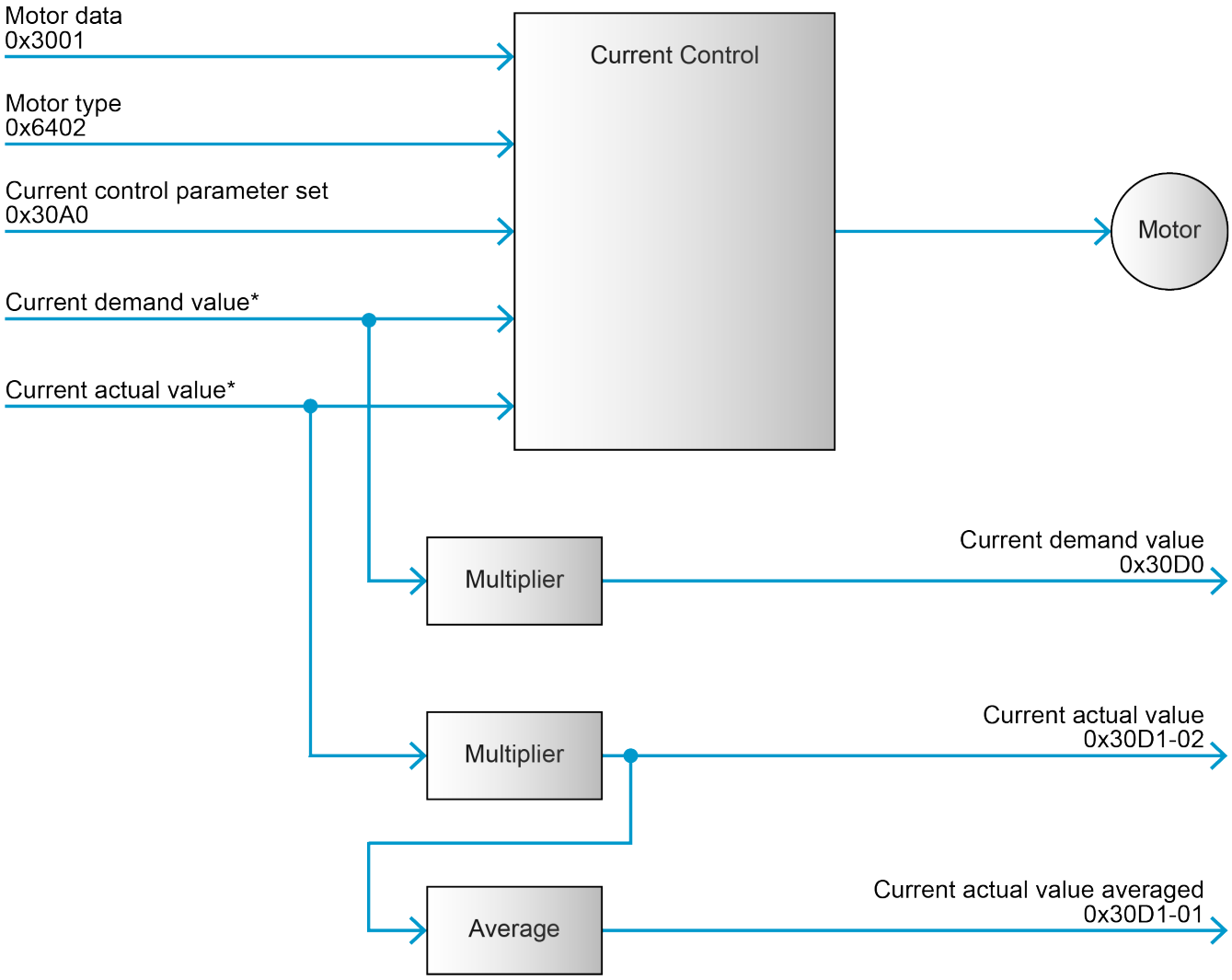

Figure 15. Current control function - Block diagram

3.9.1. How to use current control function

3.9.1.1. Configuration parameters

Parameter	Index	Description
Motor data	0x3001	Used for configuration of motor-dependent parameters
Current control parameter set	0x30A0	Configuration of the current controller gains
Motor type	0x6402	Used to define the type of motor

Table 44. Current control function - Configuration parameters

3.9.1.2. Commanding parameters

There are no commanding parameters. The current control function is commanded by the control loop Velocity control function or directly by the operating modes I/O Current Mode (IOCM) or Cyclic Synchronous Torque Mode (CST).

3.9.1.3. Output parameters

Parameter	Index	Description
Current demand value	0x30D0	Set value for current controller

Parameter	Index	Description
Current actual values	0x30D1	The averaged and actual current value

Table 45. Current control function - Output parameters

3.9.2. Limits

This limits are applicable for all current-based operating modes. Depending on the configuration, the current commanded may not be reached due to limits. When this occurs, bit 11 of the Statusword will be set. This state can also be mapped to an output pin through a Digital outputs functionality.

Limitation	Description	Effect
Output current limit	The current set value cannot be reached because it exceeds the current allowed by the object Output current limit.	The Current demand value will be limited to Output current limit.
Thermal protection motor	The current set value cannot be reached because an internal I2t model estimating the motor temperature is limiting the Current demand value, in order to prevent the motor from overheating.	The model limits the Current demand value to a maximum of between Nominal current and Output current limit. Related Objects: Nominal current, Thermal time constant winding, I2t level motor.
Thermal protection power stage	The current set value cannot be reached because the power stage temperature (measured and/or I2t model) is limiting the Current demand value, in order to prevent the power stage from overheating.	The Current demand value is limited, in the worst case to 0. Related Objects: I2t level power stage, Temperature power stage, Max temperature power stage.
Max motor speed	The current set value cannot be reached because it would result in the motor turning faster than Max motor speed.	The Current demand value is limited by the Velocity control function to prevent the motor turning faster than Max motor speed until the speed or current set value decrease.
Power stage max output level	The current set value cannot be reached because the Power stage output level actual value has reached the Power stage max output level, indicating that the required voltage cannot be reached. This may be due to the Power supply voltage being too low.	The Current actual value will be lower than the Current demand value.

Table 46. Current Operation Mode - Limits

3.9.3. Output current limitation according to I^2t method

The I^2t method is to prevent the motor from overheating. This method is based on the model of the motor's thermal dynamics which serves as the foundation for this technique. Its parameters are Nominal current and Thermal time constant winding. When the motor's I^2t level approaches 100%, the procedure reduces the output current to the nominal current. This limit is deactivated when the I^2t level of the motor falls below 90% again. Keep in mind that the Nominal current is specified under particular heat dissipation conditions and at a set ambient temperature (often 25 °C). The aforementioned settings need to be changed if these requirements are not met.

Rather than providing the thermal time constant of the winding τ_{th}, the motor manufacturer may provide the peak current Ipeak and the peak current duration Tpeak. In this case, the thermal time constant winding τ_{th} can be calculated using the following equation:

$$\tau_{th} = -\frac{T_{peak}}{\ln\left(1 - \left(\frac{I_N^2}{I_{peak}^2}\right)\right)}$$

where

ln : natural logarithm function

τ_{th} : thermal time constant winding

T_{peak} : Time during which peak current is permitted

I_{peak} : Peak current

I_N : Nominal current

The figure below shows the maximum duration of the peak current before the I^2t current limit is activated, assuming that the I^2t level motor starts at 0%. The peak current duration is normalized by the thermal time constant winding on the horizontal axis (x-axis). The vertical axis (y-axis) represents the magnitude of the peak current normalized by the nominal current.

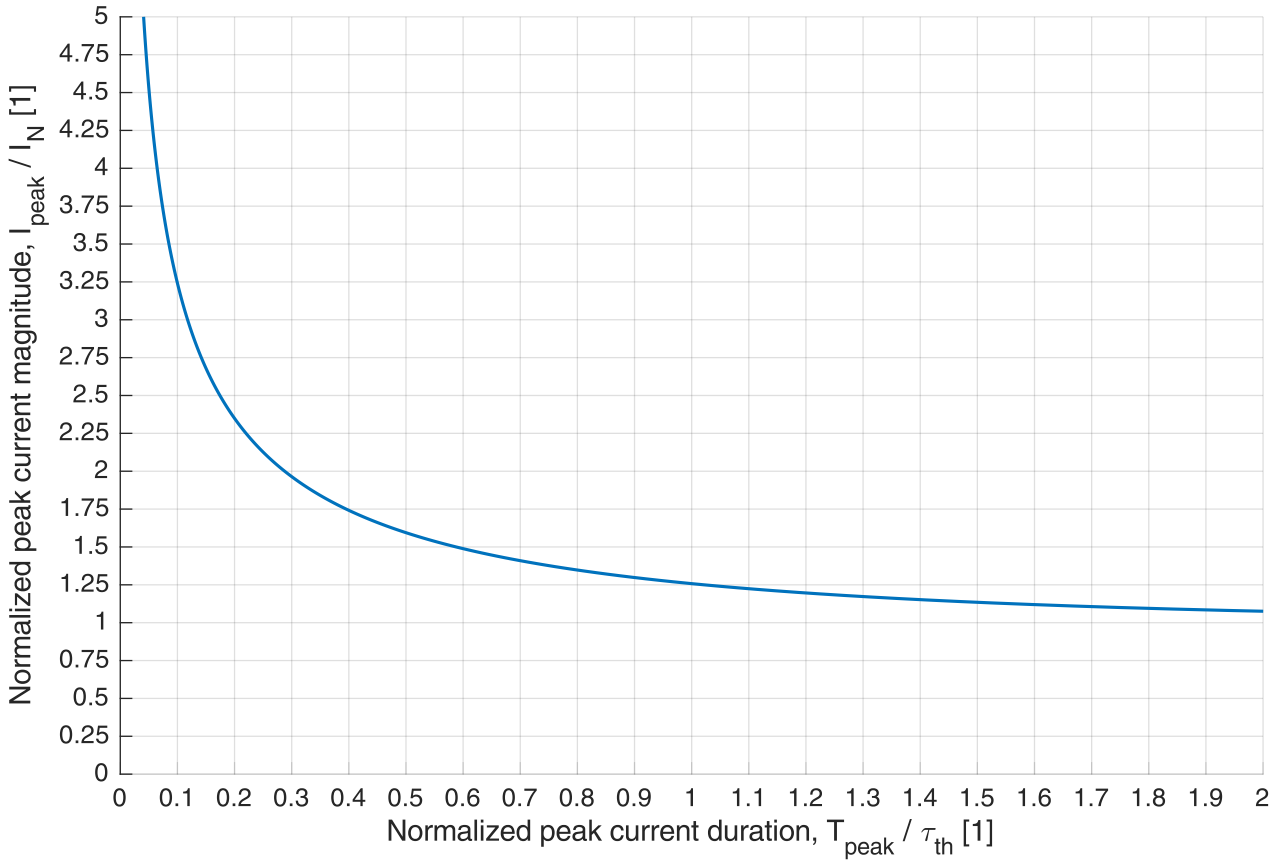

Figure 16. Normalized peak current magnitude vs. normalized peak current duration

EXAMPLE: How long can we accelerate the motor with a steady current of 2940 mA with the following motor data configuration?

- Current limit: 1470 mA
- Thermal time constant winding τ_{th}: 2.8s

To summarize and clarify the process you've described for calculating the peak current duration for a motor acceleration, follow these steps:

1. Calculate the normalized peak current magnitude:
   - Use the formula: normalized peak current = Actual peak current / Rated peak current
   - In our example, this is 2940 mA / 1470 mA = 2
2. Find the Intersection on the figure Normalized peak current magnitude vs. normalized peak current duration:
   - Use the graph of 'Normalized peak current magnitude vs. normalized peak current Duration'.

- Find the point where the normalized peak current magnitude (from step 1) intersects with the curve on the graph.
- In your example, the intersection for a normalized peak current of 2 on the blue curve corresponds to an x-axis value of approximately 0.3.

3. Calculate the peak current duration (T_{peak}):
   - Use the formula: T_{peak} = Normalized peak current duration (from graph) × Thermal time constant winding
   - In this example, T_{peak} = 0.3 × 2.8 s = 840 ms

Therefore, for a motor with these specific parameters (2940 mA peak current and 2.8 s thermal time constant winding), it can sustain the acceleration with a constant current of 2940 mA for 840 milliseconds.

The cyclic ON-OFF mode described is a common way to control motors, particularly in applications where varying the motor speed or reducing the heat generated by the motor is important. Let's break down the key components of this mode:

1. ON Time current magnitude (I_{on}):
   - This is the current magnitude when the motor is in the ON state.
   - Ion can be higher than the motor's nominal current (IN), allowing for greater torque or speed during the ON phase.
2. ON Time (T_{on}):
   - The duration for which the motor current is ON and the motor is actively powered.
3. OFF Time (T_{off}):
   - The duration for which the motor current is OFF and the motor is not powered.
   - During this time, no current flows through the motor.
4. Total Time (T_{total}):
   - The sum of the ON time and OFF time ($T_{total} = T_{on}+T_{off}$).
   - This is the complete cycle duration of one ON-OFF sequence.
5. Duty Cycle:
   - The ratio of ON time to the total time, usually expressed as a percentage.
   - Formula: Duty Cycle = (T_{total}/T_{on}) × 100%.
   - It indicates the proportion of one cycle in which the motor is active.

Understanding and controlling these parameters is crucial for efficient motor operation, especially in applications requiring precise control over motor speed, torque, or thermal management. The duty cycle, in particular, is a key parameter as it directly influences the motor's average power output and heat generation over time. Higher duty cycles mean the motor is ON for a greater proportion of the cycle, leading to increased average power output and potentially more heat generation. Conversely, a lower duty cycle reduces average power output and can help manage heat generation in the motor.

The cyclic ON-OFF mode is a very simplified model of the current profile for the case that the current to hold a constant velocity is negligible compared to the current required for acceleration and deceleration.

The following figure Cyclic mode standardized vs. standardized "ON time" shows the maximum I_{on} for continuous operation without reaching the I^2t current limit, with a given motor current duty cycle and T_{total}.

1. Motor Current Duty Cycle:
   - Represented on the horizontal axis.

- Defined as Duty Cycle = T_{total}/T_{on}
- This ratio represents the proportion of time the motor current is ON (T_{on}) in relation to the total cycle time (T_{total}).

2. 'ON Time' Current magnitude (I_{on}) normalized:
   - Shown on the vertical axis.
   - It is the ON time current magnitude (I_{on}), normalized with the motor's nominal current (IN). Essentially, this shows how much larger the ON current can be compared to the motor's typical operating current.
3. Total Time (T_{total}) and thermal time constant winding (τ_{th}):
   - Each curve on the graph represents a different ratio of the total time (T_{total}) to the thermal time constant winding (τ_{th}).
   - The thermal time constant winding is a measure of how quickly the motor heats up and cools down. Different ratios of T_{total} to τ_{th} will affect how much current the motor can handle during the ON phase without overheating.
4. Interpreting the Graph:
   - The graph is used to determine the maximum permissible Ion for continuous operation without exceeding the I^2t limit for a given duty cycle and total time.
   - For a specified duty cycle (T_{on}/T_{total}), the graph shows the maximum I_{on} (as a multiple of IN) that can be applied without causing thermal damage to the motor.
   - Different curves are useful for motors with different thermal properties (as indicated by τ_{th}).

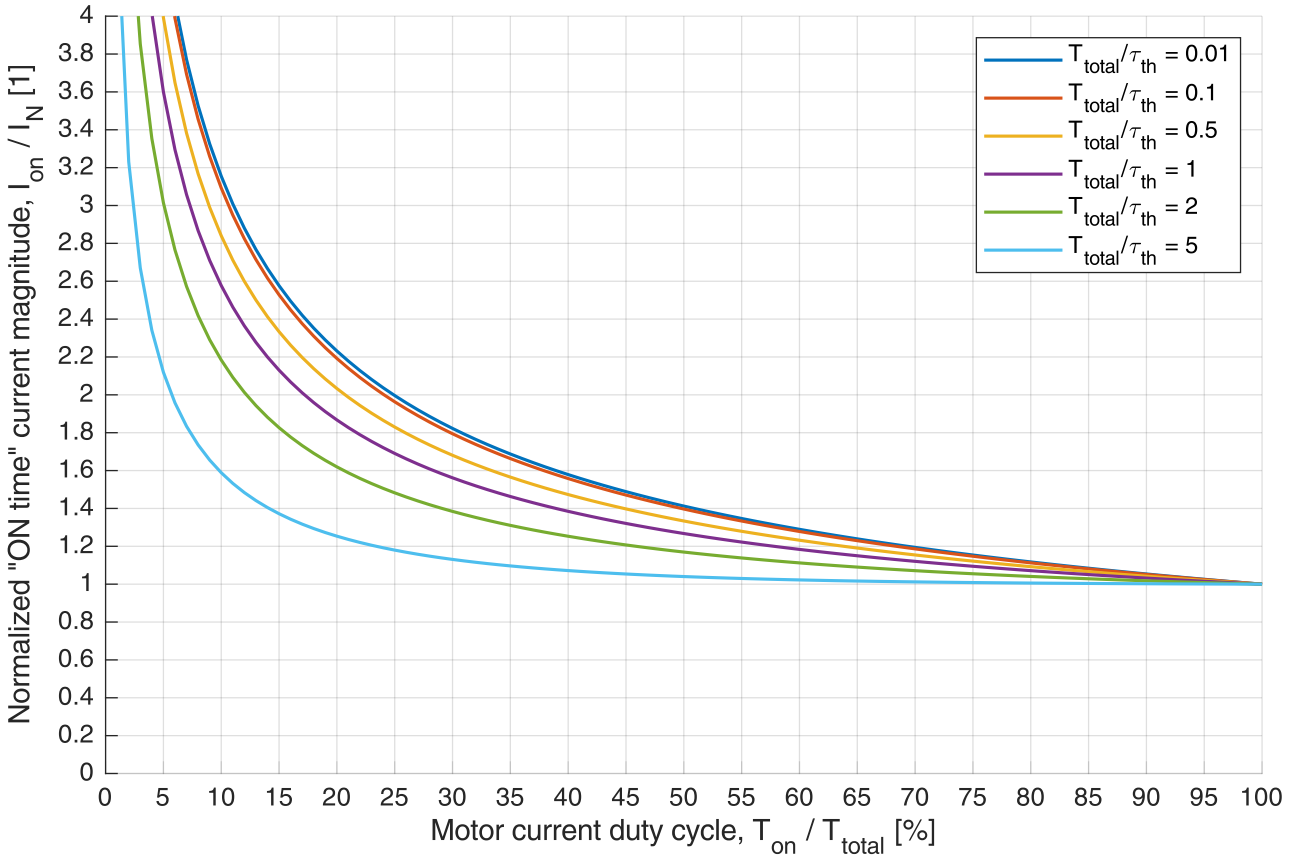

Figure 17. Cyclic mode standardized vs. standardized "ON time"

To summarize and calculate the maximum "ON time" current magnitude (for details see Motor data) (I_{on}) for the given configuration based on the cyclic ON-OFF mode, follow these steps:

1. Identify the relevant curve on the graph:
   - Since the period of the current (T_{total}) is the same as the thermal time constant winding (τ_{th}), which is 2.8s in this case, you should use the purple curve in the figure Cyclic mode standardized vs. standardized "ON time".
2. Find the Intersection on the graph:
   - Locate the point where the motor current duty cycle of 10% intersects with the purple curve on the graph.
3. Read the normalized 'ON Time' current magnitude (I_{on}) Value:
   - From the intersection point, read the y-axis value, which represents the normalized 'ON time' current magnitude. In this example, it's approximately 2.6.
4. Calculate the maximum 'ON Time' current magnitude (I_{on}):
   - Since the y-axis is normalized with the nominal current (IN), the actual Ion can be calculated by multiplying the normalized value by the nominal current.
   - Formula: I_{on} = normalized I_{on} × nominal current
   - In this example: Ion=2.6×1470 mA=3822 mA.

Therefore, for this specific motor configuration operating in an ON-OFF cyclic mode with a duty cycle of 10%, the maximum 'ON time' current magnitude that can be applied without exceeding the motor's thermal limits is approximately 3822 mA.

4. Inputs and outputs

For further information on voltage levels, resolutions, bandwidth and switching delays, consult the related controller's hardware reference manual [11].

4.1. Digital inputs

For process control, there are predefined functions and general-purpose inputs available.
The digital input function configuration is done with Configuration of digital inputs, the polarity is set with Digital input properties.
The functionality state is read using Digital inputs functionality (all functionalities) and Digital inputs (CiA-specified functionalities), while the input logic state is read with Digital input properties.

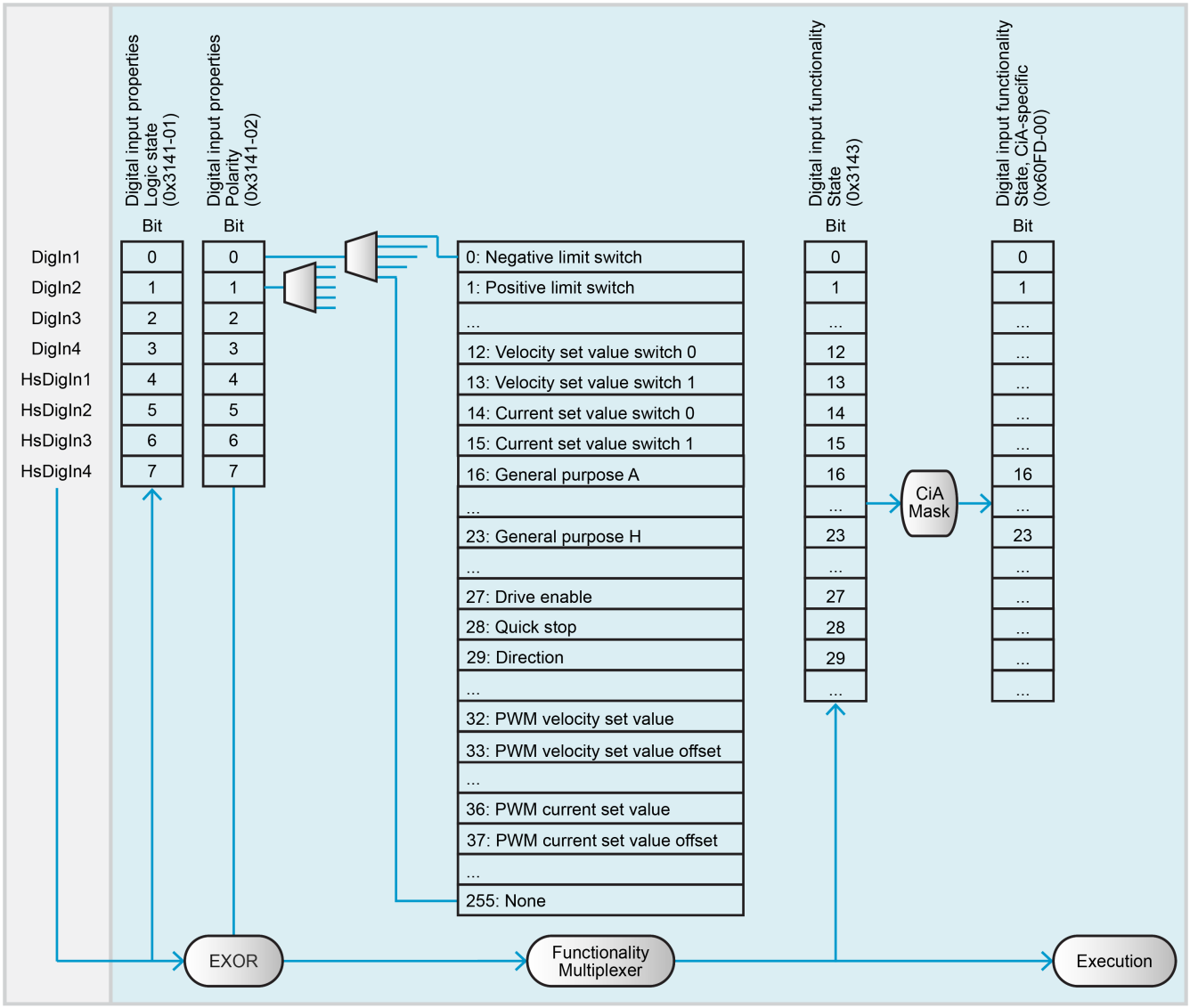

Figure 18. Digital input functionality

4.1.1. Digital input timing behavior

- **Software filter**
  To prevent spikes, the digital inputs are filtered. The input level needs to stay steady for longer than the filter time in order to detect a state change (edge). The filter lengths are
  - 1ms for "regular" digital inputs

- 500µs for high-speed digital inputs.

- **Update rates**
  The digital input functionality states (Digital inputs, Digital inputs functionality) and the Digital input properties are updated with 1 kHz.

4.2. Digital outputs

Predefined functions and general-purpose outputs are available for process control.

The configuration of the digital output functions is configured with Configuration of digital outputs, while the polarity is modified with Digital outputs polarity.

Digital outputs will be used to set the functionality state, and the logic state of the corresponding pin will be read using the Digital outputs logic state.

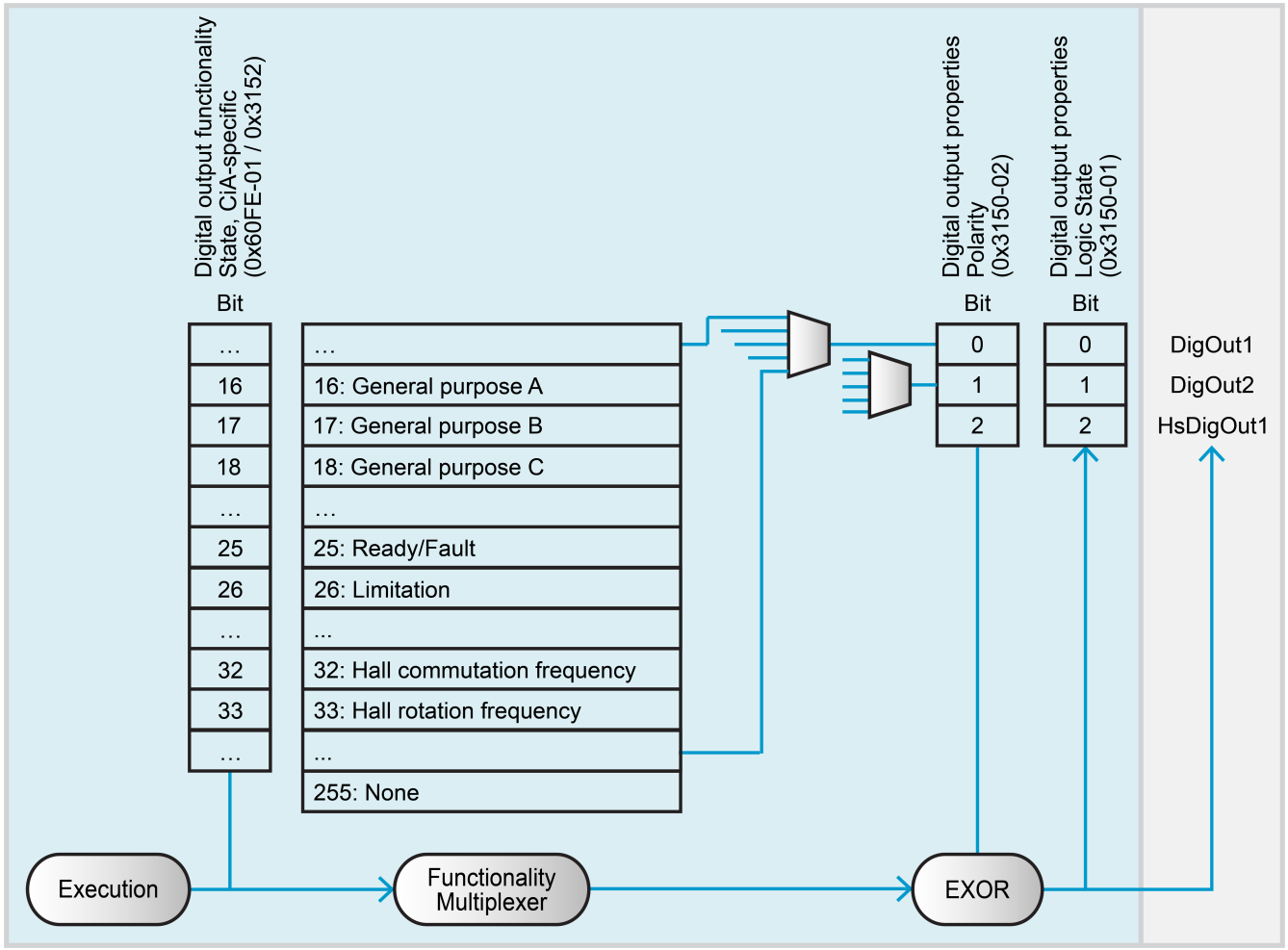

Figure 19. Digital output functionality

4.2.1. Digital output timing behavior

- **Update rates**
  The digital output logic states are updated with 10 kHz. The functionality states Physical outputs are updated when written.

4.3. Analog inputs

The analog inputs may be used for general purpose process values, such as temperature, pressure, torque from

an external sensor, etc. The values are listed in Analog input properties.

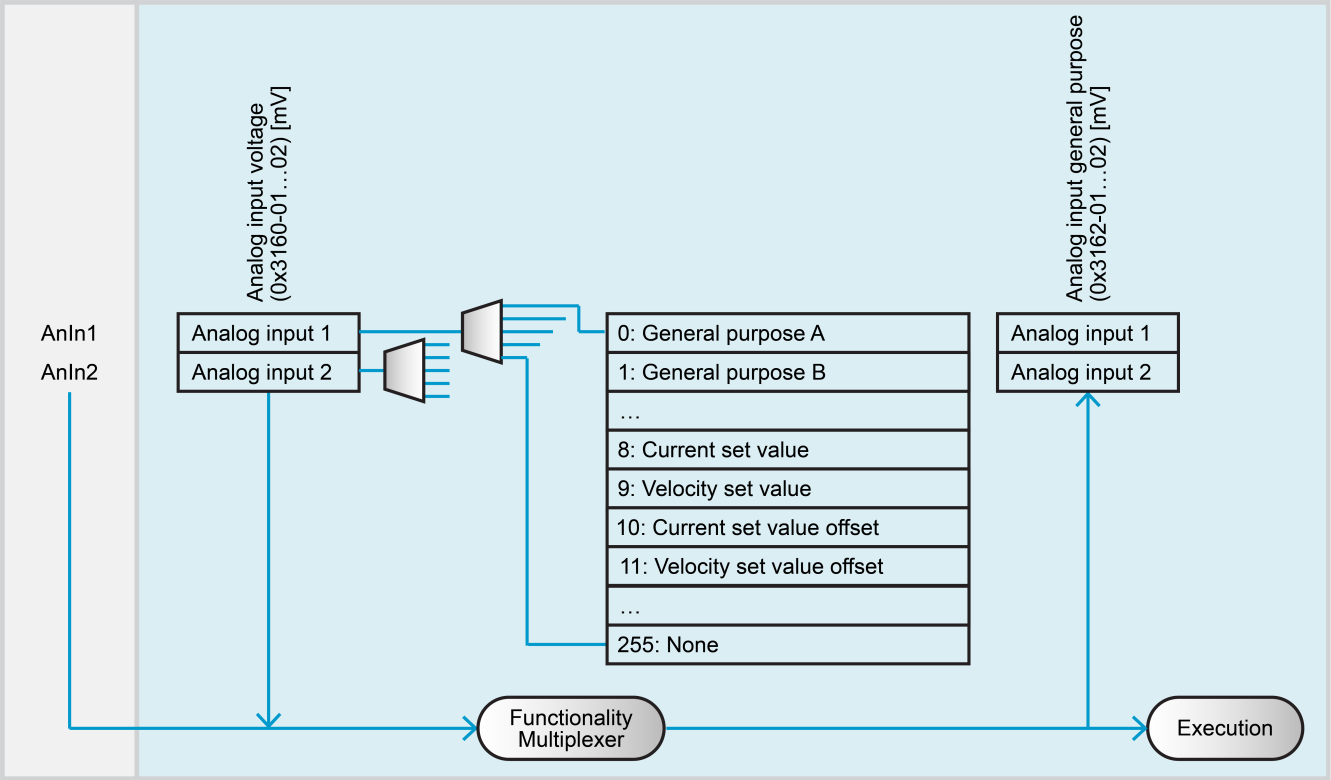

Figure 20. Analog input functionality

4.3.1. Analog input timing behavior

- **Update rates**
  Only the analog input properties and analog input raw values are updated at 50 kHz. For further usage, these values are low pass filtered with a cut-off frequency of 10kHz.

Therefore, as an example, the following objects see a low pass filtered analog input voltage:

- Analog input general purpose A
- Analog input general purpose B
- Velocity set value first voltage
- Velocity set value second voltage
- Current set value first voltage
- Current set value second voltage
- …

4.4. Analog outputs

The analog outputs are open to a variety of uses. These outputs are set by Analog output general purpose and displayed in Analog output properties.
The configuration of analog output functions is done with Configuration of analog outputs.

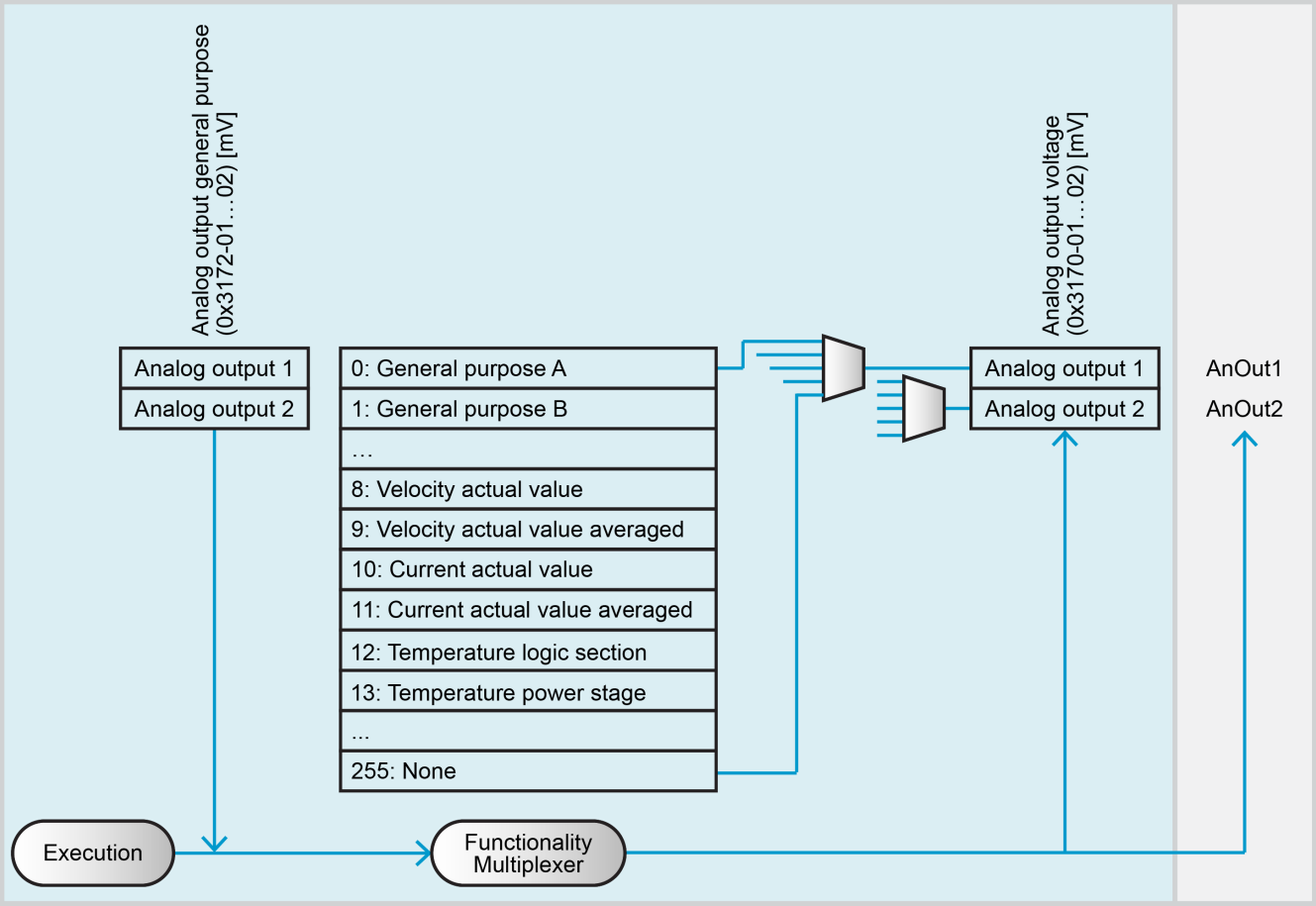

Figure 21. Analog output functionality

4.4.1. Analog output timing behavior

- **Update rates**
  The analog output properties are updated at 50 kHz, according to the digital output logic. The functionality states Analog output general purpose are updated when written.

5. Communication

The device supports communication profiles for USB, SCI (Serial Communication Interface) and CANopen. You can find detailed information on the subject in the separate document ESCON2 Communication Guide [10].

5.1. USB & SCI communication

For USB and Serial Communication Interface (SCI), maxon ESCON2 drives use the identical protocol «maxon serial protocol V2». This communication can only be used for point-to-point communication between a master and a single ESCON2 slave. The devices USB interface follows the «Universal Serial Bus Specification Revision 2.0». The devices serial communication interface uses either logic signals (for onboard communication only) or the RS232 standard (for board-to-board communication) to transmit data over a 3-wire cable (signals TxD, RxD, and GND).

Caution:
 The serial communication interface is not supported on ESCON2 Compact 60/30.

Find details here:

- ESCON2 Communication Guide [10], chapter “USB & Serial communication (SCI)”.

5.2. CAN communication

The ESCON2 CAN interface follows the CiA CANopen specifications as referenced in Sources for additional information.

Find details here:

- ESCON2 Communication Guide [10], chapter “CAN communication”.

6. Object dictionary

6.1. Overview

6.1.1. Object data types

Index	Name	Base type	Description	Size [Bits]	Range
0x0001	BOOLEAN	BOOL	False/True	1	0.1
0x0002	INTEGER8	SINT	Short Integer	8	$-2^{7}…2^{7}-1$
0x0003	INTEGER16	INT	Integer	16	$-2^{15}…2^{15}-1$
0x0004	INTEGER32	DINT	Double Integer	32	$-2^{31}…2^{31}-1$
0x0015	INTEGER64	LINT	Long Integer	64	$-2^{63}…2^{63}-1$
0x0005	UNSIGNED8	USINT	Unsigned Short Integer	8	$0…2^{8}-1$
0x0006	UNSIGNED16	UINT	Unsigned Integer	16	$0…2^{16}-1$
0x0007	UNSIGNED32	UDINT	Unsigned Double Integer	32	$0…2^{32}-1$
0x001B	UNSIGNED64	ULINT	Unsigned Long Integer	64	$0…2^{64}-1$
0x0009	VISIBLE_STRING	STRING(n)	Visible String(1 octet per character)	8*n	-
0x000A	OCTET_STRING	ARRAY[0…n] of USINT	Sequence of octets (data type USINT)	8*(n+1)	-
0x0021	PDO_MAPPING	-	PDO mapping Parameter Record	-	-
0x0023	IDENTITY	-	Identity Parameter Record	-	-

Table 47. Object data types

6.1.2. Object codes

Object code	Object name
0x0007	VAR
0x0008	ARRAY
0x0009	RECORD

Table 48. Object codes

6.1.3. Object access types

Access type	Description
RW	read and write access
RO	read only access
WO	write only access
CONST	read only access value is constant

Table 49. Object access types

6.1.4. Object flags

Flag	Code	Description
PDO mapping	TXPDO, RXPDO	Entry can be mapped as TxPdo or as RxPdo
Persistent	YES/NO	Entry can be stored/not stored in non-volatile memory

Table 50. Object flags

6.1.5. Entries overview

Index	Name	Object code
0x1000	Device type	VAR
0x1001	Error register	VAR
0x1003	Error history	ARRAY
0x1005	COB-ID SYNC	VAR
0x1008	Manufacturer device name	VAR
0x1010	Store parameters	ARRAY
0x1011	Restore default parameters	ARRAY
0x1014	COB-ID EMCY	VAR
0x1015	Inhibit time EMCY	VAR
0x1016	Consumer heartbeat time	ARRAY
0x1017	Producer heartbeat time	VAR
0x1018	Identity object	RECORD
0x1029	Error behavior	ARRAY
0x1200	SDO server parameter	RECORD
0x1400	Receive PDO 1 parameter	RECORD
0x1401	Receive PDO 2 parameter	RECORD
0x1402	Receive PDO 3 parameter	RECORD
0x1403	Receive PDO 4 parameter	RECORD
0x1600	Receive PDO 1 mapping	RECORD
0x1601	Receive PDO 2 mapping	RECORD
0x1602	Receive PDO 3 mapping	RECORD
0x1603	Receive PDO 4 mapping	RECORD
0x1800	Transmit PDO 1 parameter	RECORD
0x1801	Transmit PDO 2 parameter	RECORD
0x1802	Transmit PDO 3 parameter	RECORD
0x1803	Transmit PDO 4 parameter	RECORD
0x1A00	Transmit PDO 1 mapping	RECORD
0x1A01	Transmit PDO 2 mapping	RECORD
0x1A02	Transmit PDO 3 mapping	RECORD
0x1A03	Transmit PDO 4 mapping	RECORD
0x1F50	Program data	ARRAY
0x1F51	Program control	ARRAY
0x1F56	Program software identification	ARRAY
0x1F57	Flash status identification	ARRAY
0x2000	Node-ID	VAR
0x2001	CAN bit rate	VAR
0x2002	Serial communication interface bit rate	VAR
0x200A	CAN bit rate display	VAR
0x2100	Additional identity	RECORD

Index	Name	Object code
0x210C	Custom persistent memory	ARRAY
0x2200	Power supply	RECORD
0x2201	Power supply supervision	RECORD
0x2202	Thermal protection	RECORD
0x3000	Axis configuration	RECORD
0x3001	Motor data	RECORD
0x3002	Electrical system parameters	RECORD
0x3010	Digital incremental encoder S2	RECORD
0x301A	Digital Hall sensor S1	RECORD
0x30A0	Current control parameter set	RECORD
0x30A2	Velocity control parameter set	RECORD
0x30D0	Current demand value	VAR
0x30D1	Current actual values	ARRAY
0x30D2	Torque actual values	ARRAY
0x30D3	Velocity actual values	ARRAY
0x30F0	Target current	VAR
0x30F1	Current offset	VAR
0x3141	Digital input properties	RECORD
0x3142	Configuration of digital inputs	ARRAY
0x3143	Digital inputs functionality	VAR
0x3146	Velocity set value switch parameter	ARRAY
0x3147	Current set value switch parameter	ARRAY
0x314B	Digital input PWM frequencies	ARRAY
0x314C	Digital input PWM duty cycles	ARRAY
0x3150	Digital outputs properties	RECORD
0x3151	Configuration of digital outputs	ARRAY
0x3152	Digital outputs functionality	VAR
0x3160	Analog input properties	ARRAY
0x3161	Configuration of analog inputs	ARRAY
0x3162	Analog input general purpose	ARRAY
0x3163	Analog input adjustment	RECORD
0x3164	Analog input raw values	ARRAY
0x3170	Analog output properties	ARRAY
0x3171	Configuration of analog outputs	ARRAY
0x3172	Analog output general purpose	ARRAY
0x3180	Digital input PWM velocity set value scaling	RECORD
0x3181	Digital input PWM velocity set value offset scaling	RECORD
0x3184	Digital input PWM current set value scaling	RECORD
0x3185	Digital input PWM current set value offset scaling	RECORD
0x31B0	Analog input velocity set value scaling	RECORD

Index	Name	Object code
0x31B1	Analog input velocity set value offset scaling	RECORD
0x31B4	Analog input current set value scaling	RECORD
0x31B5	Analog input current set value offset scaling	RECORD
0x31C1	Analog output velocity scaling	RECORD
0x31C2	Analog output current scaling	RECORD
0x31C3	Analog output temperature scaling	RECORD
0x3200	Thermal protection motor	RECORD
0x3201	Thermal protection power stage	RECORD
0x3203	Motor control	RECORD
0x6007	Abort connection option code	VAR
0x603F	Error code	VAR
0x6040	Controlword	VAR
0x6041	Statusword	VAR
0x605A	Quick stop option code	VAR
0x605B	Shutdown option code	VAR
0x605C	Disable operation option code	VAR
0x605D	Halt option code	VAR
0x605E	Fault reaction option code	VAR
0x6060	Modes of operation	VAR
0x6061	Modes of operation display	VAR
0x606B	Velocity demand value	VAR
0x606C	Velocity actual value	VAR
0x6071	Target torque	VAR
0x6076	Motor rated torque	VAR
0x6077	Torque actual value	VAR
0x607F	Max profile velocity	VAR
0x6080	Max motor speed	VAR
0x6083	Profile acceleration	VAR
0x6084	Profile deceleration	VAR
0x6085	Quick stop deceleration	VAR
0x6086	Motion profile type	VAR
0x60A9	SI unit velocity	VAR
0x60AA	SI unit acceleration	VAR
0x60B1	Velocity offset	VAR
0x60B2	Torque offset	VAR
0x60C2	Interpolation time period	RECORD
0x60C5	Max acceleration	VAR
0x60E5	Additional velocity actual values	ARRAY
0x60FD	Digital inputs	VAR
0x60FE	Digital outputs	ARRAY

Index	Name	Object code
0x60FF	Target velocity	VAR
0x6402	Motor type	VAR
0x6502	Supported drive modes	VAR

Table 51. Object dictionary (overview)

6.2. Objects

6.2.1. Device type

Describes the device type. The lower word stands for the supported device profile number. The device adheres to CiA 402 CANopen device profile for drives and motion control [6] if the value is 0x0192 (402). The higher word contains details about the drive type. Servo drives are those with the value 0x0002.

Name	Device type	
Index	0x1000	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RO	
Default value	0x00020192	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.2. Error register

The error register for the device. The device maps internal errors in this byte.

Name	Error register
Index	0x1001
Subindex	0x00
Data type	UNSIGNED8
Access type	RO
Default value	-
Value range	Error Register Bits
PDO mapping	NO
Persistent	NO

Bit	Description
7	Manufacturer specific
6	Reserved (always 0)
5	Device profile-specific
4	Communication error
3	Temperature error
2	Voltage error
1	Current error

Bit	Description
0	Generic error

Table 52. Error Register Bits

6.2.3. Error history

Holds errors that have occurred on the device and have been signaled via the emergency object.

Name	Error history
Index	0x1003
Object code	ARRAY
Highest subindex supported	5

6.2.3.1. Number of errors

Contains the number of actual errors that are recorded in the array starting at subindex 1. Writing a "0" (zero) deletes the error history (empties the array). Values greater than "0" (zero) are permitted to write.

Name	Number of errors	
Index	0x1003	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	0	
Value range	0	5
PDO mapping	NO	
Persistent	NO	

6.2.3.2. Error history 1

Every new error code is stored at subindex 1, the older ones move down the list. The error numbers compose of a 16-bit error code and 16-bit additional error information on higher word.

Errors without a device state change are marked with 0x8000 (bit31) in additional error information.

Name	Error history 1	
Index	0x1003	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

Bit	Value	Description
31	0	Error
	1	Warning (without effect on device states)

Bit	Value	Description
30…16	0	Reserved
15…0	Error code	Device error code

Table 53. Error history structure

6.2.3.3. Error history 2

Name	Error history 2	
Index	0x1003	
Subindex	0x02	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.3.4. Error history 3

Name	Error history 3	
Index	0x1003	
Subindex	0x03	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.3.5. Error history 4

Name	Error history 4	
Index	0x1003	
Subindex	0x04	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.3.6. Error history 5

Name	Error history 5
Index	0x1003

Subindex	0x05	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.4. COB-ID SYNC

Communication object identifier of the synchronization object.

Name	COB-ID SYNC	
Index	0x1005	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	0x00000080	
Value range	0x00000080	0x00000080
PDO mapping	NO	
Persistent	NO	

6.2.5. Manufacturer device name

Holds the manufacturer device name.

Name	Manufacturer device name	
Index	0x1008	
Subindex	0x00	
Data type	VISIBLE_STRING	
Access type	RO	
Default value	ESCON2	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.6. Store parameters

Controls the saving of configuration parameters in a non-volatile memory.

Name	Store parameters
Index	0x1010
Object code	ARRAY
Highest subindex supported	1

To prevent accidental storage of parameters, store parameters only when you write a specific signature to the relevant subindex.

BYTE	MSB			LSB
Character	'e'	'v'	'a'	's'
Hex value	0x65	0x76	0x61	0x73

Table 54. Store Parameters Signature Values

During read access, the device always returns the value 0x00000001 because it can store parameters only on command.

Bit	RW	Description
31…2	X	Reserved
1 (auto)	1	The device saves parameters autonomously
	0	The device does not save parameters autonomously
0 (cmd)	1	The device saves parameters on command
	0	The device does not save parameters on command

Table 55. Store Parameters State Values

6.2.6.1. Save all parameters

In the event that the code "save" is written to the object, all device parameters will be saved in a non-volatile memory.

Name	Save all parameters
Index	0x1010
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x00000001
Value range	Store Parameters Signature Values
PDO mapping	NO
Persistent	NO

6.2.7. Restore default parameters

Configuration parameters are restored to the default values. Restoring the default parameters is permitted in NMT state «Pre-Operational» and device state «Power Disable» (see Device control) only. The default values are only set as valid after the device is reset or power cycled.

Name	Restore default parameters
Index	0x1011
Object code	ARRAY
Highest subindex supported	1

In order to avoid restoring of default parameters by mistake, restoring should only be executed when a specific signature is written to the respective subindex. On read access, the device will always return the value 0x00000001.

BYTE	MSB			LSB
Character	'd'	'a'	'o'	'l'

BYTE	MSB			LSB
Hex value	0x64	0x61	0x6F	0x6C

Table 56. Restore default parameters signature values

6.2.7.1. Restore all default parameters

In the event that the code "load" is written to the object, all device parameters will be restored to their default values.

Name	Restore all default parameters
Index	0x1011
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x00000001
Value range	Restore default parameters signature values
PDO mapping	NO
Persistent	NO

6.2.8. COB-ID EMCY

The Communication object identifier of the emergency object.
See ESCON2 Communication Guid [10], chapter “CAN communication”.

Name	COB-ID EMCY	
Index	0x1014	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RO	
Default value	0x0000'0080 + Node-ID	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

If the Node-ID is 255 (invalid node ID), the Valid bit is set to 1, and the 11-bit CAN ID is 0x0000.

Bit	Value	Value range	Description
31	Valid	0	EMCY exists / is valid
		1	EMCY does not exist / is not valid
30…11	Reserved	0	do not care
10…0	11-bit CAN ID	0x081…0x0FF	11-bit CAN-ID of the CAN base frame
		0x0000 (if valid = 1)	

Table 57. COB-ID used by EMCY – Bits

6.2.9. Inhibit time EMCY

If more than one error occurs within the specified time, the device sends only the last EMCY frame. The device does not send EMCY frames in the NMT state state "Stopped".

See ESCON2 Communication Guide [10], chapter “CAN communication”.

The value is given in units of [0.1 ms].

Name	Inhibit time EMCY	
Index	0x1015	
Subindex	0x00	
Data type	UNSIGNED16	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.10. Consumer heartbeat time

This object defines the expected cycle time of the heartbeat. The heartbeat time must be higher than the heartbeat time that is set on the CANopen device that produces the heartbeat. Monitoring starts after the first heartbeat is received.
The value is given in milliseconds [ms].

If the heartbeat time is set to “0” (zero), the Node-ID can also be set to “0” (zero). In this case, the object entry is not used. It is recommended to set the consumer heartbeat time to at least 20 ms higher than the producer’s heartbeat time.
Typically, the master (or another slave) produces the heartbeat. Therefore, it is not recommended to set the producer Node-ID in this object to the same Node-ID that this device uses.
In case of a CAN heartbeat error, you can define the device behavior with Error behavior.

Name	Consumer heartbeat time
Index	0x1016
Object code	ARRAY
Highest subindex supported	2

Bit 31…24	Bit 23…16	Bit 15…0
Reserved	Node-ID	heartbeat time

Table 58. Consumer heartbeat time - Structure

6.2.10.1. Consumer 1 heartbeat time

Name	Consumer 1 heartbeat time
Index	0x1016
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	Consumer heartbeat time - Structure
PDO mapping	NO
Persistent	YES

6.2.10.2. Consumer 2 heartbeat time

Name	Consumer 2 heartbeat time
Index	0x1016
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	Consumer heartbeat time - Structure
PDO mapping	NO
Persistent	YES

6.2.11. Producer heartbeat time

This object defines the cycle time of the heartbeat. If the value is set to "0" (zero), the producer heartbeat is disabled.
The value is given in milliseconds [ms].

Name	Producer heartbeat time	
Index	0x1017	
Subindex	0x00	
Data type	UNSIGNED16	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.12. Identity object

Provides general identification information about the device.

Name	Identity object
Index	0x1018
Object code	RECORD
Highest subindex supported	4

The Firmware version history provides more detailed information about the versions.

6.2.12.1. Vendor ID

Unique vendor identification for "maxon motor ag", defined by CiA.

Name	Vendor ID
Index	0x1018
Subindex	0x01
Data type	UNSIGNED32
Access type	RO

Default value	0x000000FB	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.12.2. Product code

The high word contains the hardware version. The low word contains the application number.

Name	Product code	
Index	0x1018	
Subindex	0x02	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

Hardware version	Hardware
0x1101	ESCON2 Module 60/30 ESCON2 Compact 60/30
0x1102	ESCON2 Micro 60/5
0x1103	ESCON2 Nano 24/2

Table 59. Definition of hardware version

6.2.12.3. Revision number

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

Name	Revision number	
Index	0x1018	
Subindex	0x03	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.12.4. Serial number

This object contains the last 8 digits of the device serial number.
Related object: Serial number complete

Name	Serial number
Index	0x1018

Subindex	0x04	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.13. Error behavior

This object allows you to define the device behavior in case of a specific error.

Name	Error behavior
Index	0x1029
Object code	ARRAY
Highest subindex supported	1

6.2.13.1. Communication error

This object defines the device behavior in case of CAN heartbeat error.

Name	Communication error
Index	0x1029
Subindex	0x01
Data type	UNSIGNED8
Access type	RW
Default value	0x00
Value range	Error Behaviour in case of CAN heartbeat error
PDO mapping	NO
Persistent	YES

Value	Description
0	Change to NMT state Pre-operational (only if currently in NMT state Operational)
1	No change of NMT state

Table 60. Error Behaviour in case of CAN heartbeat error

6.2.14. SDO server parameter

Name	SDO server parameter
Index	0x1200
Object code	RECORD
Highest subindex supported	2

6.2.14.1. COB-ID SDO client to server

This object shows the communication object identifier for service data objects from the master to the device.
Related object: Node-ID

Name	COB-ID SDO client to server
Index	0x1200
Subindex	0x01
Data type	UNSIGNED32
Access type	RO
Default value	0x0000'0600 + Node-ID
Value range	COB-ID used by SDO server – Bits
PDO mapping	NO
Persistent	NO

If the Node-ID is 255 (invalid node ID), the Valid bit is set to 1, and the 11-bit CAN ID is 0x0000.

Bit	Value	Value range	Description
31	Valid	0	SDO exists / is valid
		1	SDO does not exist / is not valid
30…11	Reserved	0	do not care
10…0	11-bit CAN ID	0x581…0x67F	11-bit CAN-ID of the CAN base frame
		0x0000 (if valid = 1)	

Table 61. COB-ID used by SDO server – Bits

6.2.14.2. COB-ID SDO server to client

This object shows the communication object identifier for service data objects from the device to the master.
Related object: Node-ID

Name	COB-ID SDO server to client
Index	0x1200
Subindex	0x02
Data type	UNSIGNED32
Access type	RO
Default value	0x0000'0580 + Node-ID
Value range	COB-ID used by SDO server – Bits
PDO mapping	NO
Persistent	NO

If the Node-ID is 255 (invalid node ID), the Valid bit is set to 1, and the 11-bit CAN ID is 0x0000.

6.2.15. Receive PDO 1 parameter

Name	Receive PDO 1 parameter
Index	0x1400
Object code	RECORD
Highest subindex supported	2

6.2.15.1. COB-ID used by RxPDO 1

This object shows the communication object identifier for the receive process data object.

Related object: Node-ID

Name	COB-ID used by RxPDO 1
Index	0x1400
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x0000'0200 + Node-ID
Value range	COB-ID used by RxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0x0000'0201.

Bit	Value	Value range	Description
31	Valid	0	PDO exists / is valid
		1	PDO does not exist / is not valid
30	Reserved	x	do not care
29	Frame	0	11-bit CAN-ID valid (CAN base frame)
28…11	Reserved	0	29-bit CAN-ID of the CAN extended frame (not supported)
10…0	11-bit CAN ID	0x181…0x57F	11-bit CAN-ID of the CAN base frame
		0x0000 (if valid = 1)	

Table 62. COB-ID used by RxPDO – Bits

6.2.15.2. Transmission type RxPDO 1

This object describes the communication principle of the process data object.

Name	Transmission type RxPDO 1
Index	0x1400
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

Value	Description
1	synchronous
255	asynchronous

Table 63. Transmission type - value range

6.2.16. Receive PDO 2 parameter

Name	Receive PDO 2 parameter

Index	0x1401
Object code	RECORD
Highest subindex supported	2

6.2.16.1. COB-ID used by RxPDO 2

This object shows the communication object identifier for the receive process data object.
Related object: Node-ID

Name	COB-ID used by RxPDO 2
Index	0x1401
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x8000'0300 + Node-ID
Value range	COB-ID used by RxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0x8000'0301.

6.2.16.2. Transmission type RxPDO 2

This object describes the communication principle of the process data object.

Name	Transmission type RxPDO 2
Index	0x1401
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

6.2.17. Receive PDO 3 parameter

Name	Receive PDO 3 parameter
Index	0x1402
Object code	RECORD
Highest subindex supported	2

6.2.17.1. COB-ID used by RxPDO 3

This object shows the communication object identifier for the receive process data object.
Related object: Node-ID

Name	COB-ID used by RxPDO 3

Index	0x1402
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x8000'0400 + Node-ID
Value range	COB-ID used by RxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0x8000'0401.

6.2.17.2. Transmission type RxPDO 3

This object describes the communication principle of the process data object.

Name	Transmission type RxPDO 3
Index	0x1402
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

6.2.18. Receive PDO 4 parameter

Name	Receive PDO 4 parameter
Index	0x1403
Object code	RECORD
Highest subindex supported	2

6.2.18.1. COB-ID used by RxPDO 4

This object shows the communication object identifier for the receive process data object.
Related object: Node-ID

Name	COB-ID used by RxPDO 4
Index	0x1403
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x8000'0500 + Node-ID
Value range	COB-ID used by RxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0x8000'0501.

6.2.18.2. Transmission type RxPDO 4

This object describes the communication principle of the process data object.

Name	Transmission type RxPDO 4
Index	0x1403
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

6.2.19. Receive PDO 1 mapping

This object contains the process data mapping parameters of RxPDO1. The mapping of objects is required to enable PDO processing.

- Subindex 0 shows the number of mapped objects.
- Subindex 0x01 to 0x08 show the mapped objects. The value describes the corresponding index, subindex, and length.
- The value for the length (in bits) is used to calculate the total mapping length.
- The maximum allowed length for all mapped objects is 8 bytes for CANopen.

Write access is only allowed in the NMT state «Pre-Operational».
The structure for the mapped objects in subindex 0x01 to 0x08 is as follows:

Bit 31…16	Bit 15…8	Bit 7…0
Index	Subindex	Length

Table 64. RxPDO mapping - Bits

To change the PDO mapping, perform the following procedure:

a. Write the value “0” (zero) to subindex 0x00 to disable the mapping.
b. Modify the desired objects in subindex 0x01 to 0x08.
c. Write the desired number of mapped objects to subindex 0x00.

Name	Receive PDO 1 mapping
Index	0x1600
Object code	RECORD
Highest subindex supported	8

6.2.19.1. Number of mapped objects in RxPDO 1

Name	Number of mapped objects in RxPDO 1
Index	0x1600

Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	1	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.19.2. 1st mapped object in RxPDO 1

Name	1st mapped object in RxPDO 1
Index	0x1600
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60400010
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.19.3. 2nd mapped object in RxPDO 1

Name	2nd mapped object in RxPDO 1
Index	0x1600
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.19.4. 3rd mapped object in RxPDO 1

Name	3rd mapped object in RxPDO 1
Index	0x1600
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.19.5. 4th mapped object in RxPDO 1

Name	4th mapped object in RxPDO 1
Index	0x1600
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.19.6. 5th mapped object in RxPDO 1

Name	5th mapped object in RxPDO 1
Index	0x1600
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.19.7. 6th mapped object in RxPDO 1

Name	6th mapped object in RxPDO 1
Index	0x1600
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.19.8. 7th mapped object in RxPDO 1

Name	7th mapped object in RxPDO 1
Index	0x1600
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits

PDO mapping	NO
Persistent	YES

6.2.19.9. 8th mapped object in RxPDO 1

Name	8th mapped object in RxPDO 1
Index	0x1600
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20. Receive PDO 2 mapping

This object contains the process data mapping parameters of RxPDO2.
For a detailed description, refer to Receive PDO 1 mapping, which applies by analogy.

Name	Receive PDO 2 mapping
Index	0x1601
Object code	RECORD
Highest subindex supported	8

6.2.20.1. Number of mapped objects in RxPDO 2

Name	Number of mapped objects in RxPDO 2	
Index	0x1601	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	2	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.20.2. 1st mapped object in RxPDO 2

Name	1st mapped object in RxPDO 2
Index	0x1601
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60400010
Value range	RxPDO mapping - Bits

PDO mapping	NO
Persistent	YES

6.2.20.3. 2nd mapped object in RxPDO 2

Name	2nd mapped object in RxPDO 2
Index	0x1601
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x60600008
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20.4. 3rd mapped object in RxPDO 2

Name	3rd mapped object in RxPDO 2
Index	0x1601
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20.5. 4th mapped object in RxPDO 2

Name	4th mapped object in RxPDO 2
Index	0x1601
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20.6. 5th mapped object in RxPDO 2

Name	5th mapped object in RxPDO 2
Index	0x1601
Subindex	0x05
Data type	UNSIGNED32

Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20.7. 6th mapped object in RxPDO 2

Name	6th mapped object in RxPDO 2
Index	0x1601
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20.8. 7th mapped object in RxPDO 2

Name	7th mapped object in RxPDO 2
Index	0x1601
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.20.9. 8th mapped object in RxPDO 2

Name	8th mapped object in RxPDO 2
Index	0x1601
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21. Receive PDO 3 mapping

This object contains the process data mapping parameters of RxPDO3.
For a detailed description, refer to Receive PDO 1 mapping, which applies by analogy.

Name	Receive PDO 3 mapping
Index	0x1602
Object code	RECORD
Highest subindex supported	8

6.2.21.1. Number of mapped objects in RxPDO 3

Name	Number of mapped objects in RxPDO 3	
Index	0x1602	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	2	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.21.2. 1st mapped object in RxPDO 3

Name	1st mapped object in RxPDO 3
Index	0x1602
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60400010
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.3. 2nd mapped object in RxPDO 3

Name	2nd mapped object in RxPDO 3
Index	0x1602
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x60710010
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.4. 3rd mapped object in RxPDO 3

Name	3rd mapped object in RxPDO 3
Index	0x1602

Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.5. 4th mapped object in RxPDO 3

Name	4th mapped object in RxPDO 3
Index	0x1602
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.6. 5th mapped object in RxPDO 3

Name	5th mapped object in RxPDO 3
Index	0x1602
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.7. 6th mapped object in RxPDO 3

Name	6th mapped object in RxPDO 3
Index	0x1602
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.8. 7th mapped object in RxPDO 3

Name	7th mapped object in RxPDO 3
Index	0x1602
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.21.9. 8th mapped object in RxPDO 3

Name	8th mapped object in RxPDO 3
Index	0x1602
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22. Receive PDO 4 mapping

This object contains the process data mapping parameters of RxPDO4.
For a detailed description, refer to Receive PDO 1 mapping, which applies by analogy.

Name	Receive PDO 4 mapping
Index	0x1603
Object code	RECORD
Highest subindex supported	8

6.2.22.1. Number of mapped objects in RxPDO 4

Name	Number of mapped objects in RxPDO 4	
Index	0x1603	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	2	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.22.2. 1st mapped object in RxPDO 4

Name	1st mapped object in RxPDO 4
Index	0x1603
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60400010
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22.3. 2nd mapped object in RxPDO 4

Name	2nd mapped object in RxPDO 4
Index	0x1603
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x60FF0020
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22.4. 3rd mapped object in RxPDO 4

Name	3rd mapped object in RxPDO 4
Index	0x1603
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22.5. 4th mapped object in RxPDO 4

Name	4th mapped object in RxPDO 4
Index	0x1603
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits

PDO mapping	NO
Persistent	YES

6.2.22.6. 5th mapped object in RxPDO 4

Name	5th mapped object in RxPDO 4
Index	0x1603
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22.7. 6th mapped object in RxPDO 4

Name	6th mapped object in RxPDO 4
Index	0x1603
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22.8. 7th mapped object in RxPDO 4

Name	7th mapped object in RxPDO 4
Index	0x1603
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.22.9. 8th mapped object in RxPDO 4

Name	8th mapped object in RxPDO 4
Index	0x1603
Subindex	0x08
Data type	UNSIGNED32

Access type	RW
Default value	0x00000000
Value range	RxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.23. Transmit PDO 1 parameter

Name	Transmit PDO 1 parameter
Index	0x1800
Object code	RECORD
Highest subindex supported	3

6.2.23.1. COB-ID used by TxPDO 1

This object shows the communication object identifier for the transmit process data object.
Related object: Node-ID

Name	COB-ID used by TxPDO 1
Index	0x1800
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x4000'0180 + Node-ID
Value range	COB-ID used by TxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0x4000'0181.

Bit	Value	Value range	Description
31	Valid	0	PDO exists / is valid
		1	PDO does not exist / is not valid
30	RTR	1	no RTR allowed on this PDO (not supported)
29	Frame	0	11-bit CAN-ID valid (CAN base frame)
28…11	Reserved	0	29-bit CAN-ID of the CAN extended frame (not supported)
10…0	11-bit CAN ID	0x181…0x57F	11-bit CAN-ID of the CAN base frame
		0x0000 (if valid = 1)	

Table 65. COB-ID used by TxPDO – Bits

6.2.23.2. Transmission type TxPDO 1

This object describes the communication principle of the process data object.

Name	Transmission type TxPDO 1
Index	0x1800
Subindex	0x02

Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

With transmission type 1 (synchronous), the PDO is transmitted when a SYNC frame is received.
With transmission type 255 (asynchronous), the PDO is transmitted when the data value changes. Therefore, Inhibit time TxPDO 1 defines the minimum transmission interval.

Value	Description
1	synchronous
255	asynchronous

Table 66. Transmission type - value range

6.2.23.3. Inhibit time TxPDO 1

This object represents the minimum interval for event-triggered PDO transmission. The value is defined as a multiple of 100 microseconds (µs).

Event-triggered PDOs can create high loads on both the CAN bus and the device, especially if the inhibit time of different PDOs is set to a small value.

Name	Inhibit time TxPDO 1	
Index	0x1800	
Subindex	0x03	
Data type	UNSIGNED16	
Access type	RW	
Default value	10	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.24. Transmit PDO 2 parameter

Name	Transmit PDO 2 parameter
Index	0x1801
Object code	RECORD
Highest subindex supported	3

6.2.24.1. COB-ID used by TxPDO 2

This object shows the communication object identifier for the transmit process data object.
Related object: Node-ID

Name	COB-ID used by TxPDO 2
Index	0x1801

Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0xC000'0280 + Node-ID
Value range	COB-ID used by TxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0xC000'0281.

6.2.24.2. Transmission type TxPDO 2

This object describes the communication principle of the process data object.

Name	Transmission type TxPDO 2
Index	0x1801
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

6.2.24.3. Inhibit time TxPDO 2

This object shows the minimum interval for event-triggered PDO transmission. The value is defined as a multiple of 100 microseconds (µs).

Event-triggered PDOs can create high loads on both the CAN bus and the device, especially if the inhibit time for different PDOs is set to a small value.

Name	Inhibit time TxPDO 2	
Index	0x1801	
Subindex	0x03	
Data type	UNSIGNED16	
Access type	RW	
Default value	10	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.25. Transmit PDO 3 parameter

Name	Transmit PDO 3 parameter
Index	0x1802
Object code	RECORD

Highest subindex supported	3

6.2.25.1. COB-ID used by TxPDO 3

This object shows the communication object identifier for the transmit process data object.
Related object: Node-ID

Name	COB-ID used by TxPDO 3
Index	0x1802
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0xC000'0380 + Node-ID
Value range	COB-ID used by TxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0xC000'0381.

6.2.25.2. Transmission type TxPDO 3

This object describes the communication principle of the process data object.

Name	Transmission type TxPDO 3
Index	0x1802
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

6.2.25.3. Inhibit time TxPDO 3

This object shows the minimum interval for event-triggered PDO transmission. The value is defined as a multiple of 100 microseconds (µs).

Event-triggered PDOs can create high loads on both the CAN bus and the device, especially if the inhibit time for different PDOs is set to a small value.

Name	Inhibit time TxPDO 3	
Index	0x1802	
Subindex	0x03	
Data type	UNSIGNED16	
Access type	RW	
Default value	10	
Value range	-	-

PDO mapping	NO
Persistent	YES

6.2.26. Transmit PDO 4 parameter

Name	Transmit PDO 4 parameter
Index	0x1803
Object code	RECORD
Highest subindex supported	3

6.2.26.1. COB-ID used by TxPDO 4

This object shows the communication object identifier for the transmit process data object.
Related object: Node-ID

Name	COB-ID used by TxPDO 4
Index	0x1803
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0xC0000480 + Node-ID
Value range	COB-ID used by TxPDO – Bits
PDO mapping	NO
Persistent	YES

If the Node-ID is 255 (invalid node ID), the default value is set to 0xC000'0481.

6.2.26.2. Transmission type TxPDO 4

This object describes the communication principle of the process data object.

Name	Transmission type TxPDO 4
Index	0x1803
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Transmission type - value range
PDO mapping	NO
Persistent	YES

6.2.26.3. Inhibit time TxPDO 4

This object shows the minimum interval for event-triggered PDO transmission. The value is defined as a multiple of 100 microseconds (µs).

Event-triggered PDOs can create high loads on both the CAN bus and the device, especially if the inhibit time for different PDOs is set to a small value.

Name	Inhibit time TxPDO 4	
Index	0x1803	
Subindex	0x03	
Data type	UNSIGNED16	
Access type	RW	
Default value	10	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.27. Transmit PDO 1 mapping

This object contains the process data mapping parameters of TxPDO1. The mapping of objects is required to enable PDO processing.

- Subindex 0 shows the number of mapped objects.
- Subindex 0x01 to 0x08 show the mapped objects. The value describes the corresponding index, subindex, and length.
- The value for the length (in bits) is used to calculate the total mapping length.
- The maximum allowed length for all mapped objects is 8 bytes for CANopen.

Write access is only allowed in the NMT state «Pre-Operational».
The structure for the mapped objects in subindex 0x01 to 0x08 is as follows:

Bit 31…16	Bit 15…8	Bit 7…0
Index	Subindex	Length

Table 67. TxPDO mapping - Bits

To change the PDO mapping, follow this procedure:

a. Write the value "0" (zero) to subindex 0x00 to disable the mapping.
b. Modify the desired objects in subindex 0x01 to 0x08.
c. Write the desired number of mapped objects to subindex 0x00.

Name	Transmit PDO 1 mapping
Index	0x1A00
Object code	RECORD
Highest subindex supported	8

6.2.27.1. Number of mapped objects in TxPDO 1

Name	Number of mapped objects in TxPDO 1
Index	0x1A00
Subindex	0x00
Data type	UNSIGNED8
Access type	RW
Default value	1

Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.27.2. 1st mapped object in TxPDO 1

Name	1st mapped object in TxPDO 1
Index	0x1A00
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60410010
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.3. 2nd mapped object in TxPDO 1

Name	2nd mapped object in TxPDO 1
Index	0x1A00
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.4. 3rd mapped object in TxPDO 1

Name	3rd mapped object in TxPDO 1
Index	0x1A00
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.5. 4th mapped object in TxPDO 1

Name	4th mapped object in TxPDO 1
Index	0x1A00
Subindex	0x04

Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.6. 5th mapped object in TxPDO 1

Name	5th mapped object in TxPDO 1
Index	0x1A00
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.7. 6th mapped object in TxPDO 1

Name	6th mapped object in TxPDO 1
Index	0x1A00
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.8. 7th mapped object in TxPDO 1

Name	7th mapped object in TxPDO 1
Index	0x1A00
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.27.9. 8th mapped object in TxPDO 1

Name	8th mapped object in TxPDO 1
Index	0x1A00
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28. Transmit PDO 2 mapping

This object shows the process data mapping parameters of TxPDO2.
For a detailed description, refer to Transmit PDO 1 mapping, which applies by analogy.

Name	Transmit PDO 2 mapping
Index	0x1A01
Object code	RECORD
Highest subindex supported	8

6.2.28.1. Number of mapped objects in TxPDO 2

Name	Number of mapped objects in TxPDO 2	
Index	0x1A01	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	2	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.28.2. 1st mapped object in TxPDO 2

Name	1st mapped object in TxPDO 2
Index	0x1A01
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60410010
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28.3. 2nd mapped object in TxPDO 2

Name	2nd mapped object in TxPDO 2
Index	0x1A01
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x60610008
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28.4. 3rd mapped object in TxPDO 2

Name	3rd mapped object in TxPDO 2
Index	0x1A01
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28.5. 4th mapped object in TxPDO 2

Name	4th mapped object in TxPDO 2
Index	0x1A01
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28.6. 5th mapped object in TxPDO 2

Name	5th mapped object in TxPDO 2
Index	0x1A01
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits

PDO mapping	NO
Persistent	YES

6.2.28.7. 6th mapped object in TxPDO 2

Name	6th mapped object in TxPDO 2
Index	0x1A01
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28.8. 7th mapped object in TxPDO 2

Name	7th mapped object in TxPDO 2
Index	0x1A01
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.28.9. 8th mapped object in TxPDO 2

Name	8th mapped object in TxPDO 2
Index	0x1A01
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29. Transmit PDO 3 mapping

This object shows the process data mapping parameters of TxPDO3.
For a detailed description, refer to Transmit PDO 1 mapping, which applies by analogy.

Name	Transmit PDO 3 mapping
Index	0x1A02

Object code	RECORD
Highest subindex supported	8

6.2.29.1. Number of mapped objects in TxPDO 3

Name	Number of mapped objects in TxPDO 3	
Index	0x1A02	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	2	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.29.2. 1st mapped object in TxPDO 3

Name	1st mapped object in TxPDO 3
Index	0x1A02
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60410010
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.3. 2nd mapped object in TxPDO 3

Name	2nd mapped object in TxPDO 3
Index	0x1A02
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x60770010
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.4. 3rd mapped object in TxPDO 3

Name	3rd mapped object in TxPDO 3
Index	0x1A02
Subindex	0x03
Data type	UNSIGNED32

Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.5. 4th mapped object in TxPDO 3

Name	4th mapped object in TxPDO 3
Index	0x1A02
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.6. 5th mapped object in TxPDO 3

Name	5th mapped object in TxPDO 3
Index	0x1A02
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.7. 6th mapped object in TxPDO 3

Name	6th mapped object in TxPDO 3
Index	0x1A02
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.8. 7th mapped object in TxPDO 3

Name	7th mapped object in TxPDO 3

Index	0x1A02
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.29.9. 8th mapped object in TxPDO 3

Name	8th mapped object in TxPDO 3
Index	0x1A02
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30. Transmit PDO 4 mapping

This object shows the process data mapping parameters of TxPDO4.
For a detailed description, refer to Transmit PDO 1 mapping, which applies by analogy.

Name	Transmit PDO 4 mapping
Index	0x1A03
Object code	RECORD
Highest subindex supported	8

6.2.30.1. Number of mapped objects in TxPDO 4

Name	Number of mapped objects in TxPDO 4	
Index	0x1A03	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	2	
Value range	0 (Mapping disabled)	8
PDO mapping	NO	
Persistent	YES	

6.2.30.2. 1st mapped object in TxPDO 4

Name	1st mapped object in TxPDO 4

Index	0x1A03
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x60410010
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.3. 2nd mapped object in TxPDO 4

Name	2nd mapped object in TxPDO 4
Index	0x1A03
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x606C0020
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.4. 3rd mapped object in TxPDO 4

Name	3rd mapped object in TxPDO 4
Index	0x1A03
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.5. 4th mapped object in TxPDO 4

Name	4th mapped object in TxPDO 4
Index	0x1A03
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.6. 5th mapped object in TxPDO 4

Name	5th mapped object in TxPDO 4
Index	0x1A03
Subindex	0x05
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.7. 6th mapped object in TxPDO 4

Name	6th mapped object in TxPDO 4
Index	0x1A03
Subindex	0x06
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.8. 7th mapped object in TxPDO 4

Name	7th mapped object in TxPDO 4
Index	0x1A03
Subindex	0x07
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits
PDO mapping	NO
Persistent	YES

6.2.30.9. 8th mapped object in TxPDO 4

Name	8th mapped object in TxPDO 4
Index	0x1A03
Subindex	0x08
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	TxPDO mapping - Bits

PDO mapping	NO
Persistent	YES

6.2.31. Program data

This object is used to download a firmware file (msdc). The download will start only if both a stop program command and a clear program command are immediately received by Program control.
Related object: Program control.

Name	Program data
Index	0x1F50
Object code	ARRAY
Highest subindex supported	1

6.2.31.1. Program number 1

Name	Program number 1	
Index	0x1F50	
Subindex	0x01	
Data type	OCTET_STRING	
Access type	WO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.32. Program control

This object initiates firmware download-related commands and provides information about the running application.

While the bootloader is active, only a limited set of objects is supported, and only one communication interface can be used. For example, the bootloader is activated with the stop program command. When in bootloader mode, only one communication interface is accepted at a time. The first command received by the bootloader determines which interface is used. You can only change the communication interface after a device reset or a start program command.

To successfully perform a firmware update, follow this command sequence:

1. Stop the program.
2. Clear the program.
3. Download the program with write access to Program data.

Related object: Program data.

Name	Program control
Index	0x1F51
Object code	ARRAY
Highest subindex supported	1

6.2.32.1. Program number 1

Write access is permitted in NMT state «Pre-Operational» and device state «Power Disable» (see Device control) only.

Name	Program number 1
Index	0x1F51
Subindex	0x01
Data type	UNSIGNED8
Access type	RW
Default value	-
Value range	Program control – value ranges
PDO mapping	NO
Persistent	NO

Value	Write access	Read access
0x00	Stop program: Activate bootloader application	Program stopped: Bootloader application is active
0x01	Start program: Activate Program	Program started: Program is active
0x02	Reset program: Initiate device reset	Not used
0x03	Clear program: Erase the flash memory before new program data is downloaded	No program available: No valid application is available in the flash memory

Table 68. Program control – value ranges

6.2.33. Program software identification

This object shows identification for the loaded program software.
If no valid flash content or program software is available, the program software identification is "0" (zero). While the bootloader is active, the identification of the currently running bootloader version is returned. After a bootloader update, a device reset or a start program command is required to display the new identification number.

Name	Program software identification
Index	0x1F56
Object code	ARRAY
Highest subindex supported	1

6.2.33.1. Program number 1

Name	Program number 1
Index	0x1F56
Subindex	0x01
Data type	UNSIGNED32
Access type	RO
Default value	-
Value range	Program software identification – Bits

PDO mapping	NO
Persistent	NO

Bit	Description
31…16	Identification of the application
15…0	Identification of the bootloader

Table 69. Program software identification – Bits

6.2.34. Flash status identification

This object shows the status of the firmware download process.

Name	Flash status identification
Index	0x1F57
Object code	ARRAY
Highest subindex supported	1

6.2.34.1. Program number 1

Name	Program number 1
Index	0x1F57
Subindex	0x01
Data type	UNSIGNED32
Access type	RO
Default value	-
Value range	Flash status identification – Bits
PDO mapping	NO
Persistent	NO

Bit	Value	Description
31…16		Manufacturer-specific information
15…8		Reserved, always 0

Bit	Value	Description
7…1	127…68	Reserved for manufacturer-specific errors
	67	Decryption error
	66	Authentication sequence error: The expected command sequence (activate bootloader – clear program – write program data) was not observed.
	65	Flash clear error
	64	Hardware version mismatch. The received firmware cannot be used with this hardware; manufacturer-specific error
	63	Unspecified error
	62…8	Reserved
	7	Flash secured. Write access is currently forbidden.
	6	General address error
	5	Flash write error
	4	Flash not cleared before write
	3	Data format error or data CRC error
	2	Data format unknown
	1	No valid program available
	0	No error occurred, valid program available
0	1	Download in progress. Program software identification is not valid.
	0	No download in progress. Program software identification is valid.

Table 70. Flash status identification – Bits

6.2.35. Node-ID

This object defines the node ID of the device and is used by the communication interfaces: CAN, USB, and SCI.

If the node ID hardware signals are not set to logic 0, the hardware signals define the node ID. The device reads the value at boot-up and after a communication reset, then displays it in this object. If the node ID hardware signals are set to logic 0, you can define the node ID by using this object. For detailed information on node ID hardware signals, see the controller's hardware reference manual [11].

Changes to this object only take effect after a restart. Therefore, it is necessary to store all parameters after a change and then restart, or perform a communication reset.

The default value, 255, is an invalid node ID. The user must change this to a valid node ID by using the USB or CAN LSS communication interface.
For more information on LSS, see the ESCON2 Communication Guide [10], chapter "Layer Setting Services (LSS)".

Name	Node-ID	
Index	0x2000	
Subindex	0x00	
Data type	UNSIGNED8	
Access type	RW	
Default value	255	
Value range	1	127
PDO mapping	NO	

Persistent	YES

6.2.36. CAN bit rate

This object holds the desired bit rate of the CAN interface. Changes to this object only take effect after a restart. Therefore, it is necessary to store all parameters after a change and then restart, or perform a communication reset.

Automatic bit rate detection is activated in the following cases:

- The CAN bit rate is set to “9” and saved, followed by a reset or power-on.
- The hardware signal “CAN automatic bit rate detection” is set to logic 1 during a reset or power-on. For detailed information, refer to the controller’s hardware reference manual [11].

Name	CAN bit rate
Index	0x2001
Subindex	0x00
Data type	UNSIGNED8
Access type	RW
Default value	0
Value range	CAN bit rates
PDO mapping	NO
Persistent	YES

Value	Bit rate
0	1 Mbit/s
1	800 kbit/s
2	500 kbit/s
3	250 kbit/s
4	125 kbit/s
(5)	(reserved)
6	50 kbit/s
7	20 kbit/s
(8)	(not supported, 10 kbit/s)
9	Automatic bit rate detection

Table 71. CAN bit rates

6.2.37. Serial communication interface bit rate

This object sets the bit rate of the serial communication interface.
Changes to this object only take effect after a restart. Therefore, you must save all parameters after making a change and then restart.

Caution:	
	The SCI interface is not supported on ESCON2 Compact 60/30.

Name	Serial communication interface bit rate
Index	0x2002
Subindex	0x00
Data type	UNSIGNED8
Access type	RW
Default value	5
Value range	SCI bit rates
PDO mapping	NO
Persistent	YES

Value	Bit rate
0	9.6 kbit/s
1	14.4 kbit/s
2	19.2 kbit/s
3	38.4 kbit/s
4	57.6 kbit/s
5	115.2 kbits/s

Table 72. SCI bit rates

6.2.38. CAN bit rate display

This object shows the currently configured CAN bit rate. Its value can differ from the value of CAN bit rate if automatic bit rate detection is or was active. In all other cases, the values of these two objects are identical.
Related object: CAN bit rate.

Name	CAN bit rate display
Index	0x200A
Subindex	0x00
Data type	UNSIGNED8
Access type	RO
Default value	-
Value range	CAN bit rates display
PDO mapping	NO
Persistent	NO

Value	Bit rate
0	1 Mbit/s
1	800 kbit/s
2	500 kbit/s
3	250 kbit/s
4	125 kbit/s
(5)	(not used)
6	50 kbit/s
7	20 kbit/s

Value	Bit rate
(8)	(not used)
9	Automatic bit rate detection

Table 73. CAN bit rates display

6.2.39. Additional identity

Name	Additional identity
Index	0x2100
Object code	RECORD
Highest subindex supported	1

6.2.39.1. Serial number complete

Contains the full 64-bit device serial number.

Name	Serial number complete	
Index	0x2100	
Subindex	0x01	
Data type	UNSIGNED64	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.40. Custom persistent memory

Name	Custom persistent memory
Index	0x210C
Object code	ARRAY
Highest subindex supported	4

6.2.40.1. Custom persistent memory 1

You can use this object to store custom values (for example, axis numbers or identifications) on the device. The firmware does not evaluate these values, but the set parameters return to their default values.
See related object Restore default parameters.

Name	Custom persistent memory 1	
Index	0x210C	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RW	
Default value	0x00000000	
Value range	-	-
PDO mapping	NO	

Persistent	YES

6.2.40.2. Custom persistent memory 2

Name	Custom persistent memory 2	
Index	0x210C	
Subindex	0x02	
Data type	UNSIGNED32	
Access type	RW	
Default value	0x00000000	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.40.3. Custom persistent memory 3

Name	Custom persistent memory 3	
Index	0x210C	
Subindex	0x03	
Data type	UNSIGNED32	
Access type	RW	
Default value	0x00000000	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.40.4. Custom persistent memory 4

Name	Custom persistent memory 4	
Index	0x210C	
Subindex	0x04	
Data type	UNSIGNED32	
Access type	RW	
Default value	0x00000000	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.41. Power supply

This object is used to display the power supply parameters.

Name	Power supply
Index	0x2200
Object code	RECORD
Highest subindex supported	1

6.2.41.1. Power supply voltage

This object shows the actual power supply voltage. The value is given in units of 0.1 volts [0.1 V].

Note:
 If the device is only powered via the logic supply, the displayed value is to be considered invalid.

Name	Power supply voltage	
Index	0x2200	
Subindex	0x01	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.42. Power supply supervision

This object is used to customize power supervision.

Name	Power supply supervision
Index	0x2201
Object code	RECORD
Highest subindex supported	2

6.2.42.1. Power supply undervoltage limit

The device can only be enabled if the supply voltage is higher than the undervoltage limit. If the supply voltage falls below this undervoltage limit while the device is enabled, Undervoltage error will be set. The error can only be cleared if the supply voltage rises above the sum of the undervoltage limit and the undervoltage hysteresis. The undervoltage limit must be lower than the overvoltage limit minus the overvoltage hysteresis and the undervoltage hysteresis.
The value is given in millivolts [mV].

Name	Power supply undervoltage limit
Index	0x2201
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	Power supply - undervoltage limit
Value range	Power supply - undervoltage limit
PDO mapping	NO
Persistent	YES

Hardware	Default	Min	Max
ESCON2 Module 60/30 ESCON2 Compact 60/30	7'500mV	7'500mV	63'750mV
ESCON2 Micro 60/5	7'500mV	7'500mV	63'750mV
ESCON2 Nano 24/2	4'500mV	4'500mV	29'000mV

Table 74. Power supply - undervoltage limit

Hardware	Undervoltage hysteresis
ESCON2 Module 60/30 ESCON2 Compact 60/30	250mV
ESCON2 Micro 60/5	250mV
ESCON2 Nano 24/2	50mV

Table 75. Power supply - undervoltage hysteresis

6.2.42.2. Power supply overvoltage limit

If the supply voltage rises above the overvoltage limit (regardless of the enabled state), Overvoltage error will be set. The error can only be cleared if the supply voltage falls below the overvoltage limit minus the overvoltage hysteresis.

The overvoltage limit must be higher than the undervoltage limit plus the undervoltage hysteresis and the overvoltage hysteresis.
The value is given in millivolts [mV].

Name	Power supply overvoltage limit
Index	0x2201
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	Power supply - overvoltage limit
Value range	Power supply - overvoltage limit
PDO mapping	NO
Persistent	YES

Hardware	Default	Min	Max
ESCON2 Module 60/30 ESCON2 Compact 60/30	65'000mV	8'750mV	65'000mV
ESCON2 Micro 60/5	65'000mV	8'750mV	65'000mV
ESCON2 Nano 24/2	31'000mV	4'550mV	31'000mV

Table 76. Power supply - overvoltage limit

Hardware	Overvoltage hysteresis
ESCON2 Module 60/30 ESCON2 Compact 60/30	1'000mV
ESCON2 Micro 60/5	1'000mV
ESCON2 Nano 24/2	2'000mV

Table 77. Power supply - overvoltage hysteresis

6.2.43. Thermal protection

Name	Thermal protection
Index	0x2202
Object code	RECORD
Highest subindex supported	1

6.2.43.1. Temperature logic section

This object shows the temperature of the logic section. Thermal logic section overload error will be set if the logic section temperature exceeds the over-temperature limit. To clear the error, the temperature must drop below the temperature limit minus the temperature hysteresis. The value is given in units of [0.1°C].

Name	Temperature logic section	
Index	0x2202	
Subindex	0x01	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Hardware	Temperature limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	108°C
ESCON2 Micro 60/5	115°C
ESCON2 Nano 24/2	108°C

Table 78. Logic section over temperature limit

Hardware	Hysteresis
ESCON2 Module 60/30 ESCON2 Compact 60/30	10°C
ESCON2 Micro 60/5	10°C
ESCON2 Nano 24/2	10°C

Table 79. Logic section over temperature hysteresis

6.2.44. Axis configuration

Used to setup the main components of the axis by configuring the sensors and the control structure. Write access is only permitted in the device state «Power Disable» (see Device control).

Related objects: Motor type

Name	Axis configuration
Index	0x3000
Object code	RECORD
Highest subindex supported	5

6.2.44.1. Sensors configuration

Used to define the sensor types used for the axis.

- If Motor type is set to “brushed DC motor”, the field value “Digital Hall sensor” is set to “none”, and cannot be set to another value.

Related objects: Digital incremental encoder S2, Digital Hall sensor S1

Name	Sensors configuration
Index	0x3000
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x00000110
Value range	Sensor configuration - Bits
PDO mapping	NO
Persistent	YES

Bit	Name	Value	Description
31..16	Reserved	0x00	–
15..8	Sensor 2 type	0x00	None
		0x01	Digital incremental encoder
7..0	Sensor 1 type	0x00	None
		0x10	Digital Hall sensor (EC motors only)

Table 80. Sensor configuration - Bits

Note:	
	For detailed information on socket and pin assignment, see the hardware reference manual [11] of the respective controller.

6.2.44.2. Control structure

Defines the control structure of the axis depending on the available sensors.

- The main sensor can only be selected if the corresponding value of Sensors configuration has been configured (i.e, not "None").
- Take into account that the control quality depends, among other factors, on the resolution of the main sensor.
- If the values in Commutation sensors are incompatible with the new control structure, Commutation sensors is set to 0 (no commutation sensors configured).

Name	Control structure
Index	0x3000
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	0x00020011

Value range	Control structure - Bits and Control structure - value range
PDO mapping	NO
Persistent	YES

Bit	Name	Value	Description
31..20	Reserved	0x00	–
19..16	Main Sensor	0x00	None
		0x01	Sensor 1
		0x02	Sensor 2
15..8	Reserved	0x00	–
7..4	Velocity control structure	0x00	None
		0x01	PI velocity controller (low-pass filter)
3..0	Current Control Structure	0x01	PI current controller

Table 81. Control structure - Bits

Value (hex)	Description	DC	EC
0x0000'0001	PI current controller No velocity controller No main sensor	x	x
0x0001'0011	PI current controller PI velocity controller (low-pass filter) Sensor 1 is main sensor	-	x
0x0002'0011	PI current controller PI velocity controller (low-pass filter) Sensor 2 is main sensor	x	x

Table 82. Control structure - value range

Note:	
	Speed limitation in current-based modes of operation is only supported if a main sensor is configured (not None). In this case, the Velocity control parameter set must be configured or tuned.

6.2.44.3. Commutation sensors

Defines the control structure of the axis dependent on the available sensors and their disposition, as well as the commutation sensors for the axis motor.
In the case of a "brushed DC motor", the value is ignored.
For “brushless DC motor", the entry may not be set to 0x0000 (no commutation sensor defined). "Sensor commutation absolute" is used for sensors that do not require additional alignment to perform commutation (e.g, digital Hall sensors). In contrast, "Sensor commutation relative" is used if additional algorithms are required to use the sensor as a commutation sensor (e.g, digital incremental encoder). Combinations of both relative and absolute commutation sensors are possible.

- Only if the relevant value of Sensors configuration is configured (i.e., not "None") may "Sensor commutation absolute" or "Sensor commutation relative" be chosen.
- A sensor must be installed on the motor shaft if it is to be utilized as a commutation sensor.
- The object Control structure is reset to 0x0000 (no commutation sensor defined) if it is written to and the new value is incompatible with the current setup. Enabling the axis will yield an error until a valid configuration is selected.

Note:
 ESCON2 uses special algorithms for the automatic runtime optimization of commutation and velocity control in Hall sensor-based systems. To activate, the velocity must exceed the minimum value of 600 rpm for several seconds.

Name	Commutation sensors
Index	0x3000
Subindex	0x03
Data type	UNSIGNED32
Access type	RW
Default value	0x00000012
Value range	Commutation sensors - Bits and Commutation sensors - value range
PDO mapping	NO
Persistent	YES

Bit	Name	Value	Description
31..8	Reserved	0x00	–
7..4	Commutation Sensor Absolute	0x00	None
		0x01	Sensor 1
3..0	Commutation Sensor Relative	0x00	None
		0x02	Sensor 2

Table 83. Commutation sensors - Bits

Value	Description	Motor type supported
0x0000'0000	No commutation sensor defined	DC motor
0x0000'0010	Sensor 1 used for commutation [a]	EC motor
0x0000'0012	Sensor 1 and Sensor 2 used for commutation [a]	EC motor
[a] The value can only be set if a supported motor type is selected (see Motor type)		

Table 84. Commutation sensors - value range

6.2.44.4. Axis configuration miscellaneous

This object defines various options for axis configuration.

Name	Axis configuration miscellaneous
Index	0x3000
Subindex	0x04
Data type	UNSIGNED32
Access type	RW
Default value	0x00000000
Value range	Axis configuration miscellaneous – Bits
PDO mapping	NO
Persistent	YES

Bit	Name	Value	Description
31..10	Reserved	0	-
9	Commutation sensor supervision	1	Commutation sensor supervision is disabled
		0	Commutation sensor supervision is enabled
8	Main sensor supervision	1	Main sensor supervision is disabled
		0	Main sensor supervision is enabled
7..1	Reserved	0	-
0	Axis polarity	1	Inverse polarity – rotational direction of the axis is CW when positive demand values are attached.
		0	Normal polarity – rotational direction of the axis is CCW when positive demand values are attached.

Table 85. Axis configuration miscellaneous – Bits

6.2.44.5. Main sensor resolution

This object displays the resolution of the main sensor in [increments/revolution].

Name	Main sensor resolution	
Index	0x3000	
Subindex	0x05	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.45. Motor data

This object is used to configure the parameters of the motor.
Some parameters are used to limit the output current according to the I2t method. For detailed motor specifications, see maxon catalog.
Related object: Motor type

Name	Motor data
Index	0x3001
Object code	RECORD
Highest subindex supported	5

6.2.45.1. Nominal current

This object represents the nominal current of the motor [mA].
Continuous operation of the motor at this current level and at 25 °C ambient will ultimately cause the winding to reach the specified maximum winding temperature. This assumes no heat sink. The value can be substantially increased if the motor mount is made of heat-dissipating materials.
Related object: Motor rated torque

Name	Nominal current
Index	0x3001

Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	Nominal current
Value range	Nominal current
PDO mapping	RXPDO
Persistent	YES

Hardware	Default	Min	Max
ESCON2 Module 60/30 ESCON2 Compact 60/30	30'000mA	0mA	30'000mA
ESCON2 Micro 60/5	5'000mA	0mA	5'000mA
ESCON2 Nano 24/2	2'000mA	0mA	2'000mA

Table 86. Nominal current

6.2.45.2. Output current limit

This object represents the maximum permissible current of the motor [mA].
We recommend setting the value to double Nominal current.
Related object: Thermal time constant winding

Name	Output current limit
Index	0x3001
Subindex	0x02
Data type	UNSIGNED32
Access type	RW
Default value	Output current limit
Value range	Output current limit
PDO mapping	RXPDO
Persistent	YES

Hardware	Default	Min	Max
ESCON2 Module 60/30 ESCON2 Compact 60/30	60'000mA	0mA	60'000mA
ESCON2 Micro 60/5	15'000mA	0mA	15'000mA
ESCON2 Nano 24/2	6'000mA	0mA	6'000mA

Table 87. Output current limit

6.2.45.3. Number of pole pairs

This object represents the number of magnetic pole pairs (number of poles divided by 2) of the rotor of a brushless DC motor (maxon EC motor/BLDC motor).
Write access is only permitted in device state «Power disabled»: Device control.
Related object: Max motor speed

Name	Number of pole pairs
Index	0x3001
Subindex	0x03

Data type	UNSIGNED8	
Access type	RW	
Default value	1	
Value range	1	255
PDO mapping	NO	
Persistent	YES	

6.2.45.4. Thermal time constant winding

This object represents the thermal time constant of the motor winding. It is used to calculate the length of time the Output current limit is permitted to be connected to the motor. The value is given in [0.1 s].

Name	Thermal time constant winding	
Index	0x3001	
Subindex	0x04	
Data type	UNSIGNED16	
Access type	RW	
Default value	40	
Value range	1	10'000
PDO mapping	NO	
Persistent	YES	

6.2.45.5. Torque constant

This object represents the motor's torque constant. The value is given in [µNm/A].
Write access is only permitted in device state «Power Disabled»: Device control.
Related object: Motor rated torque

Name	Torque constant	
Index	0x3001	
Subindex	0x05	
Data type	UNSIGNED32	
Access type	RW	
Default value	0	
Value range	0	10'000'000
PDO mapping	NO	
Persistent	YES	

6.2.46. Electrical system parameters

The system evaluates the parameters during the regulation tuning, and identification of the electrical system. They are also used during the regulation tuning, and identification of the mechanical system to calculate the torque constant and for sensor supervision.

Name	Electrical system parameters
Index	0x3002
Object code	RECORD

Highest subindex supported	2

6.2.46.1. Electrical resistance

This object represents the electrical system's resistance. The value is given in [mΩ].

Name	Electrical resistance	
Index	0x3002	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.46.2. Electrical inductance

This object represents the electrical system's inductance. The value is given in [µH].

Name	Electrical inductance	
Index	0x3002	
Subindex	0x02	
Data type	UNSIGNED16	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.47. Digital incremental encoder S2

This object defines the configuration of the digital incremental encoder for sensor 2 (S2).
Related object: Sensors configuration

Name	Digital incremental encoder S2
Index	0x3010
Object code	RECORD
Highest subindex supported	2

6.2.47.1. Digital incremental encoder number of pulses

This object defines the resolution of the digital incremental encoder. The value is given in [pulses/revolution]. Unit conversion is as follows:

$$4 * \frac{\text{pulses}}{\text{revolutions}} = \frac{\text{increments[inc]}}{\text{revolutions[rev]}} = \frac{\text{quadcounts[qc]}}{\text{revolutions[rev]}}$$

Write access is only permitted in device state «Power Disabled»: Device control.

Name	Digital incremental encoder number of pulses	
Index	0x3010	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RW	
Default value	500	
Value range	16	2'500'000
PDO mapping	NO	
Persistent	YES	

6.2.47.2. Digital incremental encoder type

This object defines the configuration of the digital incremental encoder.
Write access is only permitted in device state «Power Disabled»: Device control.

Name	Digital incremental encoder type
Index	0x3010
Subindex	0x02
Data type	UNSIGNED16
Access type	RW
Default value	0x0000
Value range	Digital incremental encoder type – Bits
PDO mapping	NO
Persistent	YES

Bit	Name	Value	Description
15…10	Reserved	0	–
9	Method	0	Speed measured as time between two sensor edges
		1	Speed measured as number of sensor edges per control cycle
8…5	Reserved	0	–
4	Direction	0	maxon
		1	Inverted (or encoder mounted on motor shaft)
3…2	Reserved	0	–
1…0	Index	0	Encoder without index (2-channel)
		1…3	Reserved

Table 88. Digital incremental encoder type – Bits

6.2.48. Digital Hall sensor S1

This object defines the configuration of the digital Hall sensor for sensor 1 (S1). Make sure to activate the digital Hall sensor using Axis configuration.

Name	Digital Hall sensor S1
Index	0x301A
Object code	RECORD

Highest subindex supported	2

6.2.48.1. Digital Hall sensor type

This object defines the configuration of the digital Hall sensor.
Write access is only permitted in device state «Power Disabled»: Device control. Non-zero writes to reserved bits are not allowed. In this case, an abort code is returned.

Name	Digital Hall sensor type
Index	0x301A
Subindex	0x01
Data type	UNSIGNED16
Access type	RW
Default value	0x0000
Value range	Digital Hall sensor type – bits
PDO mapping	NO
Persistent	YES

Bit	Name	Value	Description
15…5	Reserved	-	–
4	Method	0	Speed measured as time between two sensor edges
		1	Speed measured as number of sensor edges per control cycle
3…1	Reserved	-	–
0	Polarity	0	maxon
		1	Inverted

Table 89. Digital Hall sensor type – bits

6.2.48.2. Digital Hall sensor pattern

This object displays the actual state of the three digital Hall sensors as a pattern.

Name	Digital Hall sensor pattern	
Index	0x301A	
Subindex	0x02	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

Bit	Name
2	Digital Hall sensor 3
1	Digital Hall sensor 2
0	Digital Hall sensor 1

Table 90. Digital Hall sensor pattern – bits

6.2.49. Current control parameter set

Holds the current controller parameters. The current controller is a digital PI controller.

Name	Current control parameter set
Index	0x30A0
Object code	RECORD
Highest subindex supported	2

6.2.49.1. Current controller P gain

This object represents the proportional gain of the current controller. The value is given in

$$\left[\frac{\mu V}{A}\right]$$

Name	Current controller P gain	
Index	0x30A0	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RW	
Default value	1'171'880	
Value range	-	-
PDO mapping	RXPDO	
Persistent	YES	

6.2.49.2. Current controller I gain

This object represents the integral gain of the current controller. The value is given in

$$\left[\frac{\mu V}{A \cdot ms}\right]$$

Name	Current controller I gain	
Index	0x30A0	
Subindex	0x02	
Data type	UNSIGNED32	
Access type	RW	
Default value	3'906'250	
Value range	-	-
PDO mapping	RXPDO	
Persistent	YES	

6.2.50. Velocity control parameter set

Velocity regulation is implemented with a digital PI controller. The object holds all the parameters of the velocity controller.

Name	Velocity control parameter set
Index	0x30A2
Object code	RECORD
Highest subindex supported	5

6.2.50.1. Velocity controller P gain

This object represents the proportional gain of the velocity controller. The value is given in

$$\left[\frac{\mu A \cdot s}{rad}\right]$$

Name	Velocity controller P gain	
Index	0x30A2	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RW	
Default value	20'000	
Value range	-	-
PDO mapping	RXPDO	
Persistent	YES	

6.2.50.2. Velocity controller I gain

This object represents the integral gain of the velocity controller. The value is given in

$$\left[\frac{\mu A}{rad}\right]$$

Name	Velocity controller I gain	
Index	0x30A2	
Subindex	0x02	
Data type	UNSIGNED32	
Access type	RW	
Default value	500'000	
Value range	-	-
PDO mapping	RXPDO	
Persistent	YES	

6.2.50.3. Velocity controller FF velocity gain

This object represents the speed feedforward gain of the velocity controller. The value is given in

$$\left[\frac{\mu A \cdot s}{rad}\right]$$

Name	Velocity controller FF velocity gain

Index	0x30A2	
Subindex	0x03	
Data type	UNSIGNED32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	RXPDO	
Persistent	YES	

6.2.50.4. Velocity controller FF acceleration gain

This object represents the acceleration feedforward gain of the velocity controller. However, it is not active in I/O Velocity Mode (IOVM).
The value is given in

$$\left[\frac{\mu A \cdot s^2}{rad}\right]$$

Name	Velocity controller FF acceleration gain	
Index	0x30A2	
Subindex	0x04	
Data type	UNSIGNED32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	RXPDO	
Persistent	YES	

6.2.50.5. Velocity controller filter cut-off frequency

This object represents the velocity low-pass filter cut-off frequency of the velocity controller. The value is given in [Hz].

Name	Velocity controller filter cut-off frequency	
Index	0x30A2	
Subindex	0x05	
Data type	UNSIGNED16	
Access type	RW	
Default value	600	
Value range	1	10'000
PDO mapping	NO	
Persistent	YES	

6.2.51. Current demand value

The set value for the current controller. The value is given in [mA].

Name	Current demand value	
Index	0x30D0	
Subindex	0x00	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.52. Current actual values

Provides the actual current values.

Name	Current actual values
Index	0x30D1
Object code	ARRAY
Highest subindex supported	2

6.2.52.1. Current actual value averaged

This object represents the Current actual value filtered by 1st order digital low-pass filter with a cutoff frequency of 50 Hz. The value is given in [mA].

Name	Current actual value averaged	
Index	0x30D1	
Subindex	0x01	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.52.2. Current actual value

This object provides the actual value of the motor's current. The value is given in [mA].

Name	Current actual value	
Index	0x30D1	
Subindex	0x02	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	

Persistent	NO

6.2.53. Torque actual values

This object provides the actual torque values.

Name	Torque actual values
Index	0x30D2
Object code	ARRAY
Highest subindex supported	1

6.2.53.1. Torque actual value averaged

This object represents the Torque actual value filtered by 1st order digital low-pass filter with a cutoff frequency of 50 Hz. The value is given in

$$\left[\frac{\mathrm{MotorRatedTorque}}{1000}\right]$$

Related object: Torque actual value

Name	Torque actual value averaged	
Index	0x30D2	
Subindex	0x01	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.54. Velocity actual values

Name	Velocity actual values
Index	0x30D3
Object code	ARRAY
Highest subindex supported	1

6.2.54.1. Velocity actual value averaged

This object represents the Velocity actual value filtered by a 1-st order digital low-pass filter with a cutoff frequency of 5 Hz. Provides the actual averaged velocity value of the axis, derived by the main sensor defined in Axis configuration. If no main sensor is configured, an estimated velocity is displayed. The value is given in [velocity units].
Related objects: Velocity actual value, Additional velocity actual values

Name	Velocity actual value averaged
Index	0x30D3
Subindex	0x01

Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.55. Target current

This object indicates the configured input value for the current controller in I/O Current Mode (IOCM). The value is given in [mA].

Name	Target current	
Index	0x30F0	
Subindex	0x00	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.56. Current offset

This object indicates the configured input offset value for the current controller in I/O Current Mode (IOCM). The value is given in [mA].

Name	Current offset	
Index	0x30F1	
Subindex	0x00	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.57. Digital input properties

Related objects: Configuration of digital inputs, Digital inputs functionality, Digital inputs

Name	Digital input properties
Index	0x3141
Object code	RECORD
Highest subindex supported	2

6.2.57.1. Digital inputs logic state

This object displays the state of the digital input logic signal (before polarity correction). A bit is read as "1" if the signal at the corresponding pin is high.

If sensor 2 is configured (Sensors configuration), the bits corresponding to high-speed digital inputs 1 to 4 will be zero. The status is also zero if a PWM input functionality (Digital input 1 configuration) is configured on the corresponding input.

Name	Digital inputs logic state	
Index	0x3141	
Subindex	0x01	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Bit	Default value
7	High-speed digital input 4
6	High-speed digital input 3
5	High-speed digital input 2
4	High-speed digital input 1
3	Digital input 4
2	Digital input 3
1	Digital input 2
0	Digital input 1

Table 91. Digital input bits

6.2.57.2. Digital inputs polarity

This object is used to set the polarity of the digital input functionalities. If a bit is set to "0" (zero), the associated pin is active-high. The polarity setting has no effect if a PWM input functionality (Digital input 1 configuration) is configured on the corresponding input.
For bit description see table Digital input bits.
Related objects: Digital inputs functionality, Digital inputs.

Name	Digital inputs polarity	
Index	0x3141	
Subindex	0x02	
Data type	UNSIGNED16	
Access type	RW	
Default value	0x0000	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.58. Configuration of digital inputs

Configures the functionality that will be assigned to digital inputs.

If sensor 2 is configured (Sensors configuration), the high-speed digital inputs 1 to 4 will be disabled. This configuration cannot be overridden as long as sensor 2 is configured.

Related objects: Digital input properties, Digital inputs functionality, Digital inputs

Name	Configuration of digital inputs
Index	0x3142
Object code	ARRAY
Highest subindex supported	8

6.2.58.1. Digital input 1 configuration

Maps functions to digital inputs. Each function can only be mapped once, and each digital input can only hold one function.

Name	Digital input 1 configuration
Index	0x3142
Subindex	0x01
Data type	UNSIGNED8
Access type	RW
Default value	16
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

Value	Functionality	Description
255	None	No functionality assigned
254…38	Reserved	–
37	PWM current set value offset [a][c][e]	Set current offset over PWM input signal. Scaling Object Digital input PWM current set value offset scaling
36	PWM current set value [a][c][e]	Set current over PWM input signal. Scaling Object Digital input PWM current set value scaling
35…34	Reserved	–
33	PWM velocity set value offset [a][b][e]	Set velocity offset over PWM input signal. Scaling Object Digital input PWM velocity set value offset scaling
32	PWM velocity set value [a][b][e]	Set velocity over PWM input signal. Scaling Object Digital input PWM velocity set value scaling
31…30	Reserved	–
29	Direction [b][c][d]	Switch direction
28	Quick stop	Stop movement and switch to «Quick stop active» state (see Device control)
27	Drive enable	Enable / disable the drive or clear errors in “Fault“ state (see Device control)
26…24	Reserved	–
23	General purpose H	State can be read
22	General purpose G	State can be read

Value	Functionality	Description
21	General purpose F	State can be read
20	General purpose E	State can be read
19	General purpose D	State can be read
18	General purpose C	State can be read
17	General purpose B	State can be read
16	General purpose A	State can be read
15	Current set value switch 1 [c][e]	Select current value (see Current set value switch parameter)
14	Current set value switch 0 [c][e]	Select current value (see Current set value switch parameter)
13	Velocity set value switch 1 [b][e]	Select velocity value (see Velocity set value switch parameter)
12	Velocity set value switch 0 [b][e]	Select velocity value (see Velocity set value switch parameter)
11…2	Reserved	–
1	Positive limit switch	Generates Positive limit switch error
0	Negative limit switch	Generates Negative limit switch error
[a] Supported on Digital input 1 configuration and Digital input 2 configuration only.		
[b] In I/O Velocity Mode (IOVM) only.		
[c] In I/O Current Mode (IOCM) only.		
[d] A positive set value is inverted if direction is inactive. A positive set value is not modified if direction is active. A negative set value is limited to zero. For details, see diagrams I/O Velocity Mode - overview and I/O Current Mode - Overview.		
[e] For every target to control, only one input functionality (analog or digital) can be active.		

Table 92. Digital Inputs - Configuration

6.2.58.2. Digital input 2 configuration

Name	Digital input 2 configuration
Index	0x3142
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	17
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.58.3. Digital input 3 configuration

Name	Digital input 3 configuration
Index	0x3142
Subindex	0x03
Data type	UNSIGNED8
Access type	RW
Default value	18
Value range	Digital Inputs - Configuration

PDO mapping	NO
Persistent	YES

6.2.58.4. Digital input 4 configuration

Name	Digital input 4 configuration
Index	0x3142
Subindex	0x04
Data type	UNSIGNED8
Access type	RW
Default value	19
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.58.5. High-speed digital input 1 configuration

Name	High-speed digital input 1 configuration
Index	0x3142
Subindex	0x05
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.58.6. High-speed digital input 2 configuration

Name	High-speed digital input 2 configuration
Index	0x3142
Subindex	0x06
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.58.7. High-speed digital input 3 configuration

Name	High-speed digital input 3 configuration
Index	0x3142
Subindex	0x07
Data type	UNSIGNED8

Access type	RW
Default value	255
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.58.8. High-speed digital input 4 configuration

Name	High-speed digital input 4 configuration
Index	0x3142
Subindex	0x08
Data type	UNSIGNED8
Access type	RW
Default value	255
Value range	Digital Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.59. Digital inputs functionality

Displays the state of the CiA digital input functionalities and manufacturer-specific digital input functionalities (after polarity correction by Digital inputs polarity). A bit is read as "1" if the signal at the corresponding pin is high. For values of CiA digital input functionalities only, see Digital inputs.
Related objects: Digital input properties / Configuration of digital inputs, Digital inputs

Name	Digital inputs functionality
Index	0x3143
Subindex	0x00
Data type	UNSIGNED32
Access type	RO
Default value	-
Value range	Digital Inputs
PDO mapping	TXPDO
Persistent	NO

Bit	Functionality	Description
31..30	Reserved	–
29	Direction	Switch direction
28	Quick stop	Stop movement and switch to «Quick stop active» state (see Device control)
27	Drive enable	Enable / disable the drive or clear errors in “Fault“ state (see Device control)
26..24	Reserved	-
23	General purpose H	State can be read
22	General purpose G	State can be read
21	General purpose F	State can be read
20	General purpose E	State can be read

Bit	Functionality	Description
19	General purpose D	State can be read
18	General purpose C	State can be read
17	General purpose B	State can be read
16	General purpose A	State can be read
15	Current set value switch 1	Select current value (see Current set value switch parameter)
14	Current set value switch 0	Select current value (see Current set value switch parameter)
13	Velocity set value switch 1	Select velocity value (see Velocity set value switch parameter)
12	Velocity set value switch 0	Select velocity value (see Velocity set value switch parameter)
11..2	Reserved	-
1	Positive limit switch	Generates Positive limit switch error
0	Negative limit switch	Generates Negative limit switch error

Table 93. Digital Inputs

6.2.60. Velocity set value switch parameter

Preset velocity values to be selected by digital inputs. Values given in [velocity units]. Write access is only permitted in device state «Power Disable» (see Device control). The functionality is supported in I/O Velocity Mode (IOVM) when at least one corresponding functionality («velocity set value switch», see Digital Inputs) is mapped to a digital input pin in Configuration of digital inputs. The selected velocity is then written to Target velocity.
Unmapping both «velocity set value switch» functionalities does not restore a previously written Target velocity value.
Related objects: Configuration of digital inputs, Target velocity, SI unit velocity

Name	Velocity set value switch parameter
Index	0x3146
Object code	ARRAY
Highest subindex supported	4

«Velocity set value switch 1» input state	«Velocity set value switch 0» input state	Selected Velocity
0 (or unmapped)	0 (or umapped)	Set velocity value 0 (if at least one «velocity set value switch» functionality is mapped to a pin)
0 (or unmapped)	1	Set velocity value 1
1	0 (or unmapped)	Set velocity value 2
1	1	Set velocity value 3

Table 94. Velocity set value switch

6.2.60.1. Set velocity value 0

Name	Set velocity value 0
Index	0x3146
Subindex	0x01
Data type	INTEGER32
Access type	RW
Default value	0

Value range	-120'000 rpm	+120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.60.2. Set velocity value 1

Name	Set velocity value 1	
Index	0x3146	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-120'000 rpm	+120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.60.3. Set velocity value 2

Name	Set velocity value 2	
Index	0x3146	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-120'000 rpm	+120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.60.4. Set velocity value 3

Name	Set velocity value 3	
Index	0x3146	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-120'000 rpm	+120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.61. Current set value switch parameter

Preset current values to be selected by digital inputs. Values given in [mA]. Write access is only permitted in device state «Power Disable» (see Device control). The functionality is supported in I/O Current Mode (IOCM) when at least one corresponding functionality («current set value switch», see Digital Inputs) is mapped to a digital input pin in Configuration of digital inputs. The selected current is then written to Target current. Unmapping both «current set value switch» functionalities does not restore a previously written Target current

value.
Related objects: Configuration of digital inputs, Target current

Name	Current set value switch parameter
Index	0x3147
Object code	ARRAY
Highest subindex supported	4

«Current set value switch 1» input state	«Current set value switch 0» input state	Selected Velocity
0 (or unmapped)	0 (or umapped)	Set current value 0 (if at least one «current set value switch» functionality is mapped to a pin)
0 (or unmapped)	1	Set current value 1
1	0 (or unmapped)	Set current value 2
1	1	Set current value 3

Table 95. Current set value switch

6.2.61.1. Set current value 0

Name	Set current value 0	
Index	0x3147	
Subindex	0x01	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.61.2. Set current value 1

Name	Set current value 1	
Index	0x3147	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.61.3. Set current value 2

Name	Set current value 2
Index	0x3147
Subindex	0x03

Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.61.4. Set current value 3

Name	Set current value 3	
Index	0x3147	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.62. Digital input PWM frequencies

This object displays the actual PWM frequencies and represents the PWM signal measured at the configured digital input. Values given in [0.1 Hz].

Note:
PWM input supports a frequency range of 50…10'000 Hz. Outside this range a warning (Digital input 1 PWM frequency warning or Digital input 2 PWM frequency warning) is active and the frequency is limited to the specified range. If the PWM frequency deviates too much from the specified range and becomes unreadable, Digital input 1 PWM error or Digital input 2 PWM error is triggered and this objects displays the value of 0 Hz.

Name	Digital input PWM frequencies	
Index	0x314B	
Object code	ARRAY	
Highest subindex supported	2	

6.2.62.1. Digital input 1 PWM frequency

Name	Digital input 1 PWM frequency	
Index	0x314B	
Subindex	0x01	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.62.2. Digital input 2 PWM frequency

Name	Digital input 2 PWM frequency	
Index	0x314B	
Subindex	0x02	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.63. Digital input PWM duty cycles

This object displays the actual PWM duty cycles and represents the PWM signal measured at the configured digital input. Given in [0.1%].

Note:
 PWM input is specified to support duty cycles in the range 10…90 %. Duty cycles outside this range are limited and the device will show a Digital input 1 PWM duty cycle warning or Digital input 2 PWM duty cycle warning, but there is a slightly threshold until the warning appears. The warning disappears, if the detected duty cycle enters the valid range again. While the warning is active, the duty cycle is restricted to the range 10…90 %. When reaching a pulse width (positive or negative) smaller than 5 µs, error Digital input 1 PWM error or Digital input 2 PWM error is triggered.

Name	Digital input PWM duty cycles
Index	0x314C
Object code	ARRAY
Highest subindex supported	2

6.2.63.1. Digital input 1 PWM duty cycle

Name	Digital input 1 PWM duty cycle	
Index	0x314C	
Subindex	0x01	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.63.2. Digital input 2 PWM duty cycle

Name	Digital input 2 PWM duty cycle
Index	0x314C
Subindex	0x02
Data type	UNSIGNED16
Access type	RO

Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.64. Digital outputs properties

Related objects: Configuration of digital outputs, Digital outputs, Digital outputs functionality.

Name	Digital outputs properties
Index	0x3150
Object code	RECORD
Highest subindex supported	2

6.2.64.1. Digital outputs logic state

This object displays the digital output logic state (after polarity correction). A bit is read as “1” if the signal at the corresponding pin is high. The state is set to zero if a frequency output functionality (Configuration of digital outputs) is configured on the corresponding output.

Name	Digital outputs logic state	
Index	0x3150	
Subindex	0x01	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Bit	Description
2	High-speed digital output 1
1	Digital output 2
0	Digital output 1

Table 96. Digital output bits

6.2.64.2. Digital outputs polarity

This object is used to set the polarity of the digital outputs. If a bit is set to “1”, the associated output will be inverted; thus, “1” in Digital outputs functionality (and Digital outputs if applicable) will set the output pin low.
Polarity only applies to outputs with configured functionality (Configuration of digital outputs); not configured pins will remain zero. The polarity setting has no effect if a frequency output functionality (Configuration of digital outputs) is configured on the corresponding output.
For bit description, see Digital output bits.

Name	Digital outputs polarity
Index	0x3150
Subindex	0x02

Data type	UNSIGNED16	
Access type	RW	
Default value	0x0000	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.65. Configuration of digital outputs

This object configures the functionality that will be assigned to the digital outputs. A functionality can only be mapped to an output once, except for the frequency outputs, where only one functionality can be used simultaneously.

If sensor 2 is configured (Sensors configuration), the high-speed digital output 1 will be disabled. This configuration cannot be overridden as long as sensor 2 is configured.

Related objects: Digital outputs properties, Digital outputs functionality, Digital outputs

Name	Configuration of digital outputs
Index	0x3151
Object code	ARRAY
Highest subindex supported	3

6.2.65.1. Digital output 1 configuration

Name	Digital output 1 configuration
Index	0x3151
Subindex	0x01
Data type	UNSIGNED8
Access type	RW
Default value	Digital outputs - Default values
Value range	Digital outputs - Configuration
PDO mapping	NO
Persistent	YES

Digital Output	Default Value
DigOut1	16: General purpose A
DigOut2	17: General purpose B
HsDigOut1	255: None

Table 97. Digital outputs - Default values

Value	Functionality	Description
255	None	No functionality assigned
254..34	Reserved	-
33	Hall sensor rotation frequency	Corresponding output (DigOut1 or DigOut2) is configured as Hall sensor rotation frequency output. Functionality can only be mapped if a Hall sensor is present (Sensors configuration) and cannot be mapped to an HsDigOut.

Value	Functionality	Description
32	Hall sensor commutation frequency	Corresponding output (DigOut1 or DigOut2) is configured as Hall sensor commutation frequency output. Functionality can only be mapped if a Hall sensor is present (Sensors configuration) and cannot be mapped to an HsDigOut.
31..27	Reserved	-
26	Limitation	Active if an internal limit (Statusword Bit 11) is active
25	Ready/Fault	Inactive on device fault or fault reaction state, otherwise active
24..19	Reserved	-
18	General purpose C	State can be read/written by the host
17	General purpose B	State can be read/written by the host
16	General purpose A	State can be read/written by the host
15…0	Reserved	-

Table 98. Digital outputs - Configuration

The *Hall sensor rotation frequency* is the frequency at which the Hall sensor detects a magnetic transition (state change) as the rotor turns. It is directly related to:

- n: Motor speed [rpm]

$$f_{\text{rotation}} = \frac{n}{60s}$$

The *Hall sensor commutation frequency* is the frequency at which the motor controller needs to changes the current in the motor windings based on the rotor angle detected by the Hall sensors. This frequency is directly tied to:

- n: Motor speed [rpm]
- Number of pole pairs

$$f_{\text{commutation}} = \frac{n \cdot \text{Number of pole pairs}}{60s}$$

These two frequencies are closely related because the the motor controller must change the current in the motor windings based on the Hall sensor's input, which also occurs every time the rotors magnetic pole passes the sensor. The rotation frequency is therefor the mechanical frequency and the commutation frequency the electrical frequency.

6.2.65.2. Digital output 2 configuration

Name	Digital output 2 configuration
Index	0x3151
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	Digital outputs - Default values
Value range	Digital outputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.65.3. High-speed digital output 1 configuration

Name	High-speed digital output 1 configuration
Index	0x3151
Subindex	0x03
Data type	UNSIGNED8
Access type	RW
Default value	Digital outputs - Default values
Value range	Digital outputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.66. Digital outputs functionality

This object displays the state of the digital output functionalities (before polarity correction by Digital outputs polarity). If a bit is set to “1” and the polarity bit is set to “0”, the signal at the corresponding pin is high.
This object is read/write, however, bits 24…31 are ignored upon writing.
This value is a superset of Digital outputs
Related objects: Digital outputs properties, Configuration of digital outputs, Digital outputs.

Name	Digital outputs functionality	
Index	0x3152	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	0x0	
Value range	-	-
PDO mapping	RXPDO	
Persistent	NO	

Bit	Functionality	Description
31..27	Reserved	-
26	Limitation	Active if an internal limit (Statusword Bit 11) is active
25	Ready/Fault	Inactive on device fault or fault reaction state, otherwise active
24..19	Reserved	-
18	General purpose C	State can be read/written by the host
17	General purpose B	State can be read/written by the host
16	General purpose A	State can be read/written by the host
15…0	Reserved	-

Table 99. Digital outputs - values

6.2.67. Analog input properties

Name	Analog input properties
Index	0x3160
Object code	ARRAY

Highest subindex supported	2

6.2.67.1. Analog input 1 voltage

This object represents the voltage measured at Analog Input 1. The value is given in [mV].

Name	Analog input 1 voltage	
Index	0x3160	
Subindex	0x01	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.67.2. Analog input 2 voltage

This object represents the voltage measured at Analog Input 2. The value is given in [mV].

Name	Analog input 2 voltage	
Index	0x3160	
Subindex	0x02	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.68. Configuration of analog inputs

This object configures the functionality that will be assigned to analog inputs.
Related object: Analog input properties

Name	Configuration of analog inputs
Index	0x3161
Object code	ARRAY
Highest subindex supported	2

6.2.68.1. Analog input 1 configuration

Maps functions to analog inputs. Each function can only be mapped once, and each analog input can only hold one function.

Name	Analog input 1 configuration
Index	0x3161
Subindex	0x01

Data type	UNSIGNED8
Access type	RW
Default value	Analog Inputs - Default Values
Value range	Analog Inputs - Configuration
PDO mapping	NO
Persistent	YES

Analog Input	Default Value
AnIn1	0 : General Purpose A
AnIn2	1 : General Purpose B

Table 100. Analog Inputs - Default Values

Value	Functionality	Description
255	None	No functionality assigned
254…12	Reserved	–
11	Velocity set value offset [a]	Set Velocity offset over analog input signal. Scaling Object Analog input velocity set value offset scaling
10	Current set value offset [a]	Set Current offset over analog input signal. Scaling Object Analog input current set value offset scaling
9	Velocity set value [a]	Set Target velocity over analog input signal. Scaling Object Analog input velocity set value scaling
8	Current set value [a]	Set Target current over analog input signal. Scaling Object Analog input current set value scaling
7…2	Reserved	–
1	General purpose B	Value can be read
0	General purpose A	Value can be read
[a] For every target to control, only one input functionality (analog or digital) can be active.		

Table 101. Analog Inputs - Configuration

6.2.68.2. Analog input 2 configuration

Name	Analog input 2 configuration
Index	0x3161
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	Analog Inputs - Default Values
Value range	Analog Inputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.69. Analog input general purpose

This object displays the actual value measured at the analog inputs. The value is only displayed if the analog input is configured as general purpose. The value is given in [mV].
Related object: Analog input properties

Name	Analog input general purpose
Index	0x3162
Object code	ARRAY
Highest subindex supported	2

6.2.69.1. Analog input general purpose A

Name	Analog input general purpose A	
Index	0x3162	
Subindex	0x01	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.69.2. Analog input general purpose B

Name	Analog input general purpose B	
Index	0x3162	
Subindex	0x02	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.70. Analog input adjustment

Adjust individual analog input voltages with a gain factor and offset value. Offset is applied before gain.

Name	Analog input adjustment
Index	0x3163
Object code	RECORD
Highest subindex supported	4

6.2.70.1. Analog input 1 adjustment offset

This object represents the adjustment offset voltage of analog input 1. The value is given in [mV].

Name	Analog input 1 adjustment offset
Index	0x3163
Subindex	0x01
Data type	INTEGER32

Access type	RW	
Default value	0	
Value range	-1'000	1'000
PDO mapping	NO	
Persistent	YES	

6.2.70.2. Analog input 1 adjustment gain factor

This object represents the adjustment gain factor of analog input 1. The value is given in [1/10'000].

Name	Analog input 1 adjustment gain factor	
Index	0x3163	
Subindex	0x02	
Data type	UNSIGNED16	
Access type	RW	
Default value	10'000	
Value range	5'000	20'000
PDO mapping	NO	
Persistent	YES	

6.2.70.3. Analog input 2 adjustment offset

This object represents the adjustment offset voltage of analog input 2. The value is given in [mV].

Name	Analog input 2 adjustment offset	
Index	0x3163	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-1'000	1'000
PDO mapping	NO	
Persistent	YES	

6.2.70.4. Analog input 2 adjustment gain factor

This object represents the adjustment gain factor of analog input 2. The value is given in [1/10'000].

Name	Analog input 2 adjustment gain factor	
Index	0x3163	
Subindex	0x04	
Data type	UNSIGNED16	
Access type	RW	
Default value	10'000	
Value range	5'000	20'000
PDO mapping	NO	

Persistent	YES

6.2.71. Analog input raw values

Name	Analog input raw values
Index	0x3164
Object code	ARRAY
Highest subindex supported	2

6.2.71.1. Analog input 1 raw value

This object represents the measured Analog Input 1 as raw value [ADC counts].

Name	Analog input 1 raw value	
Index	0x3164	
Subindex	0x01	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.71.2. Analog input 2 raw value

This object represents the measured Analog Input 2 as raw value [ADC counts].

Name	Analog input 2 raw value	
Index	0x3164	
Subindex	0x02	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.72. Analog output properties

This object represents the voltage output at analog outputs. The value is given in [mV].

Name	Analog output properties
Index	0x3170
Object code	ARRAY
Highest subindex supported	2

6.2.72.1. Analog output 1 voltage

Name	Analog output 1 voltage	
Index	0x3170	
Subindex	0x01	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.72.2. Analog output 2 voltage

Name	Analog output 2 voltage	
Index	0x3170	
Subindex	0x02	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.73. Configuration of analog outputs

This object configures the functionality that will be assigned to analog outputs.

Name	Configuration of analog outputs
Index	0x3171
Object code	ARRAY
Highest subindex supported	2

Analog Output	Default value
AnalogOut1	0: General Purpose A
AnalogOut2	1: General Purpose B

Table 102. Analog outputs - Default values

Value	Functionality	Description
255	None	No functionality assigned
254..14	Reserved	-
13	Temperature power stage	Monitor temperature values as analog output voltage. Scaling object Analog output temperature scaling
12	Temperature logic section	
11	Current actual value averaged	Monitor current values as analog output voltage. Scaling object Analog output current scaling
10	Current actual value	

Value	Functionality	Description
9	Velocity actual value averaged	Monitor velocity values as analog output voltage. Scaling object Analog output velocity scaling
8	Velocity actual value	
7…2	Reserved	-
1	General purpose B	Value can be read/written by the host
0	General purpose A	Value can be read/written by the host

Table 103. Analog outputs - Configuration

6.2.73.1. Analog output 1 configuration

Name	Analog output 1 configuration
Index	0x3171
Subindex	0x01
Data type	UNSIGNED8
Access type	RW
Default value	Analog outputs - Default values
Value range	Analog outputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.73.2. Analog output 2 configuration

Name	Analog output 2 configuration
Index	0x3171
Subindex	0x02
Data type	UNSIGNED8
Access type	RW
Default value	Analog outputs - Default values
Value range	Analog outputs - Configuration
PDO mapping	NO
Persistent	YES

6.2.74. Analog output general purpose

This object is used to set the actual voltage on the analog outputs. Writing to this object only has an effect if the analog output is configured as general purpose. The value is given in [mV].
Related object: Analog output properties

Name	Analog output general purpose
Index	0x3172
Object code	ARRAY
Highest subindex supported	2

6.2.74.1. Analog output general purpose A

Name	Analog output general purpose A
Index	0x3172

Subindex	0x01
Data type	INTEGER16
Access type	RW
Default value	0
Value range	Analog Out - value range
PDO mapping	RXPDO
Persistent	YES

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV	4'000mV
ESCON2 Micro 60/5	-4'000mV	4'000mV
ESCON2 Nano 24/2	0mV	3'300mV

Table 104. Analog Out - value range

6.2.74.2. Analog output general purpose B

Name	Analog output general purpose B
Index	0x3172
Subindex	0x02
Data type	INTEGER16
Access type	RW
Default value	0
Value range	Analog Out - value range
PDO mapping	RXPDO
Persistent	YES

6.2.75. Digital input PWM velocity set value scaling

A set value function for the PWM input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the velocity set value, which is set by a PWM input value. Invalid scaling settings (first and second duty cycle identical) results in the first velocity being used (Velocity set value first velocity). The functionality is supported in I/O Velocity Mode (IOVM).

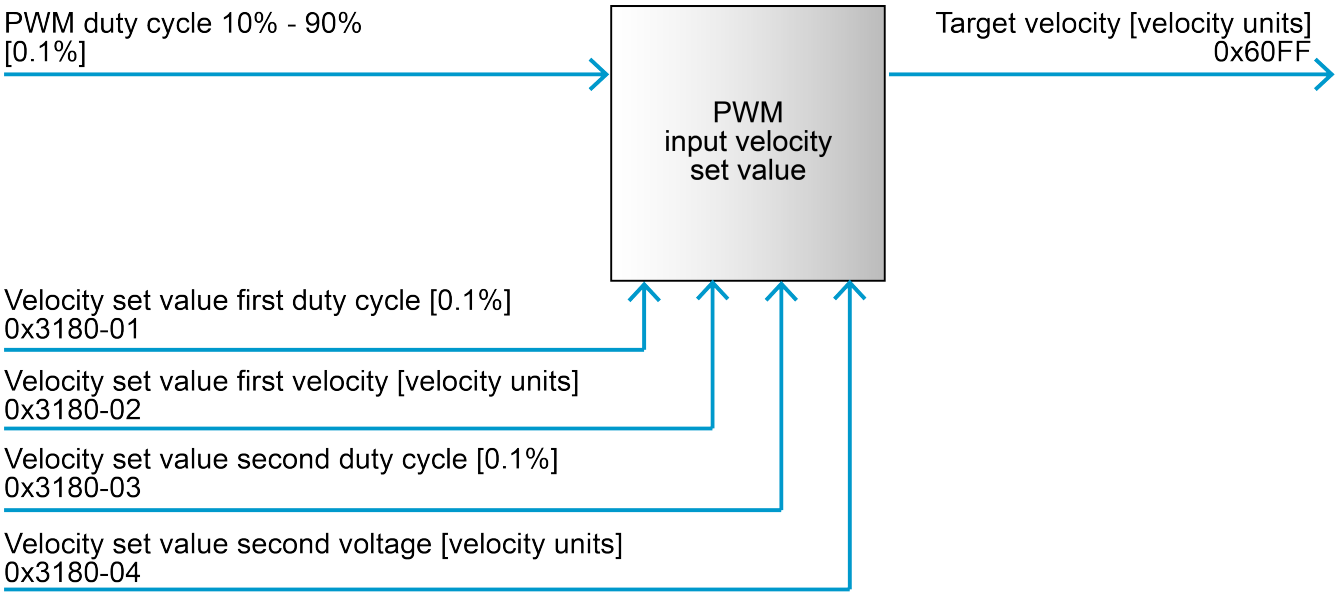

Figure 22. Digital input PWM velocity set value scaling – Set value function

Name	Digital input PWM velocity set value scaling
Index	0x3180
Object code	RECORD
Highest subindex supported	4

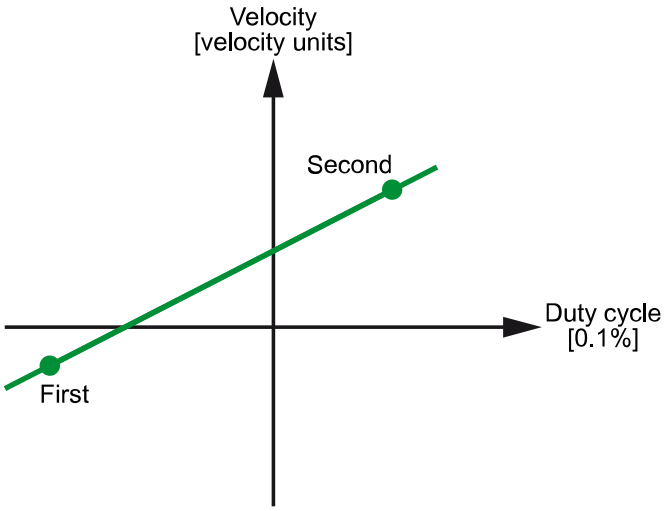

Figure 23. Digital PWM velocity set value scaling – Set value

6.2.75.1. Velocity set value first duty cycle

This object represents the set duty cycle for the first slope point. The value is given as [0.1%].

Name	Velocity set value first duty cycle
Index	0x3180
Subindex	0x01
Data type	INTEGER32
Access type	RW
Default value	100

Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.75.2. Velocity set value first velocity

This object represents the set velocity for the first slope point. The value is given in [velocity units].

Name	Velocity set value first velocity	
Index	0x3180	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.75.3. Velocity set value second duty cycle

This object represents the set duty cycle for the second slope point. The value is given as [0.1%].

Name	Velocity set value second duty cycle	
Index	0x3180	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	900	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.75.4. Velocity set value second velocity

This object represents the set velocity for the second slope point. The value is given in [velocity units].

Name	Velocity set value second velocity	
Index	0x3180	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.76. Digital input PWM velocity set value offset scaling

A set value function for the PWM input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the velocity set value offset which is set by a PWM input value. Invalid scaling settings (first and second duty cycle identical) results in the first velocity set value offset being used (Velocity set value offset first velocity). The functionality is supported in I/O Velocity Mode (IOVM).

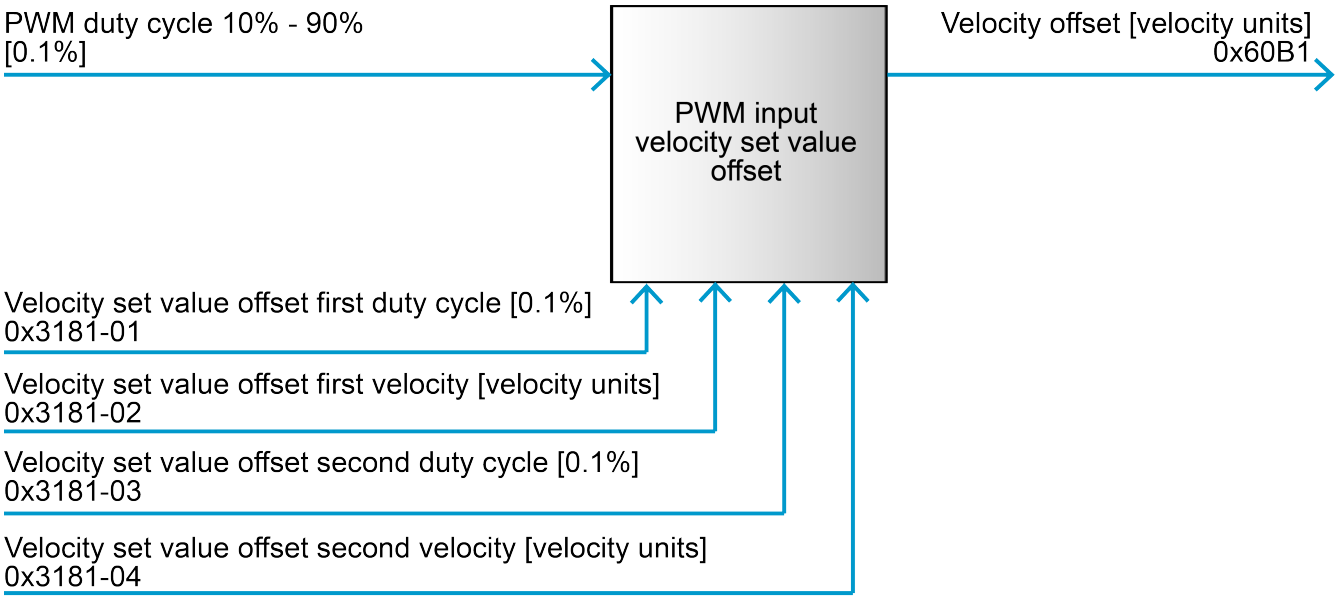

Figure 24. Digital input PWM velocity set value offset scaling – Set value function

Name	Digital input PWM velocity set value offset scaling
Index	0x3181
Object code	RECORD
Highest subindex supported	4

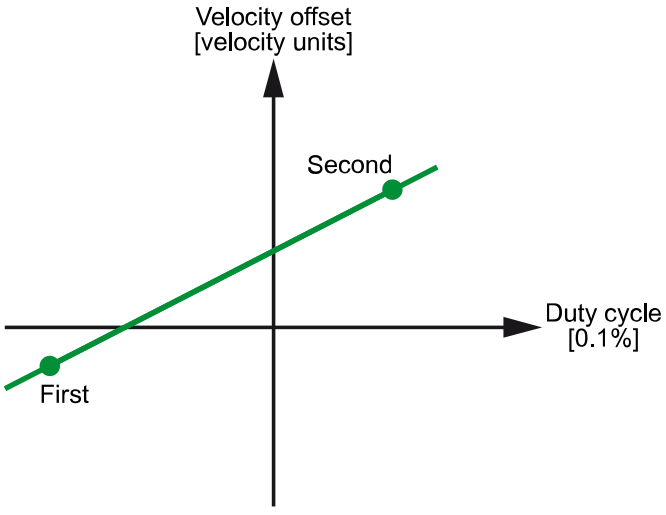

Figure 25. Digital input PWM velocity set value offset scaling – Set value

6.2.76.1. Velocity set value offset first duty cycle

This object represents the set duty cycle for the first slope point. The value is given in [0.1 %].

Name	Velocity set value offset first duty cycle

Index	0x3181	
Subindex	0x01	
Data type	INTEGER32	
Access type	RW	
Default value	100	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.76.2. Velocity set value offset first velocity

This object represents the set velocity for the first slope point. The value is given in [velocity units].

Name	Velocity set value offset first velocity	
Index	0x3181	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.76.3. Velocity set value offset second duty cycle

This object represents the set duty cycle for the second slope point. The value is given in [0.1 %].

Name	Velocity set value offset second duty cycle	
Index	0x3181	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	900	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.76.4. Velocity set value offset second velocity

This object represents the set velocity for the second slope point. The value is given in [velocity units].

Name	Velocity set value offset second velocity
Index	0x3181
Subindex	0x04
Data type	INTEGER32
Access type	RW

Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.77. Digital input PWM current set value scaling

A set value function for the PWM input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the current set value, which is set by a PWM input value. Invalid scaling settings (first and second duty cycle identical) results in the first current being used (Current set value first current). The functionality is supported in I/O Current Mode (IOCM).

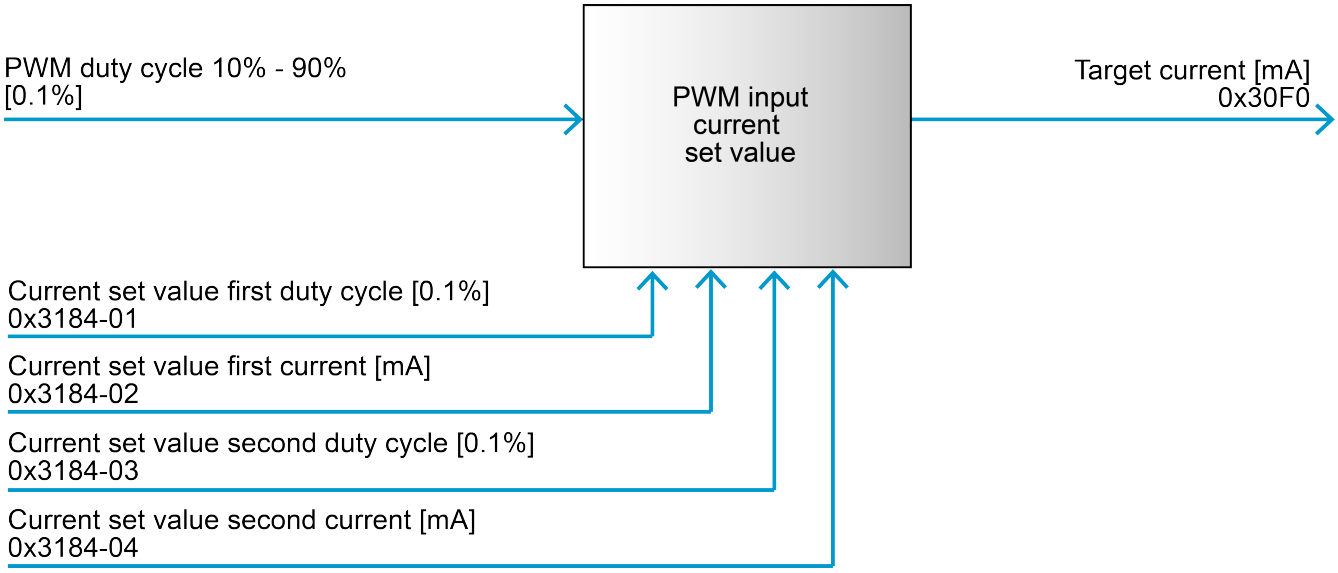

Figure 26. Digital input PWM current set value scaling – Set value function

Name	Digital input PWM current set value scaling
Index	0x3184
Object code	RECORD
Highest subindex supported	4

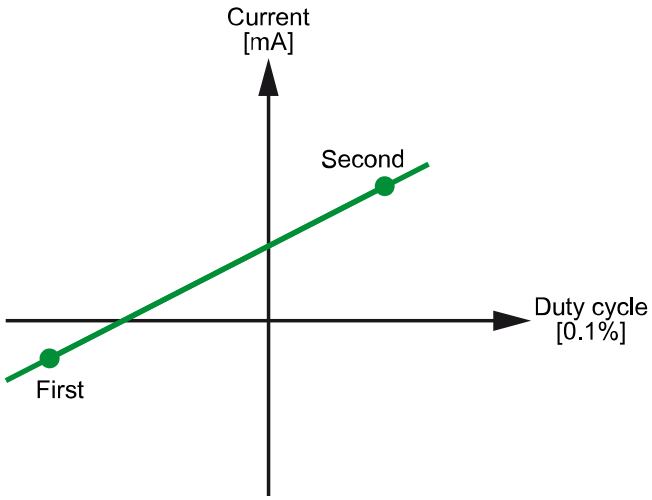

Figure 27. Digital input PWM current set value scaling – Set value

6.2.77.1. Current set value first duty cycle

This object represents the set duty cycle for the first slope point. The value is given as [0.1%].

Name	Current set value first duty cycle	
Index	0x3184	
Subindex	0x01	
Data type	INTEGER32	
Access type	RW	
Default value	100	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.77.2. Current set value first current

This object represents the output current for the first slope point. The value is given in [mA].

Name	Current set value first current	
Index	0x3184	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.77.3. Current set value second duty cycle

This object represents the set duty cycle for the second slope point. The value is given as [0.1%].

Name	Current set value second duty cycle	
Index	0x3184	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	900	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.77.4. Current set value second current

This object represents the output current for the second slope point. The value is given in [mA].

Name	Current set value second current

Index	0x3184	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.78. Digital input PWM current set value offset scaling

A set value function for the PWM input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the current set value offset which is set by a PWM input value. Invalid scaling settings (first and second duty cycle identical) results in the first current set value offset being used (Current set value offset first current). The functionality is supported in I/O Current Mode (IOCM).

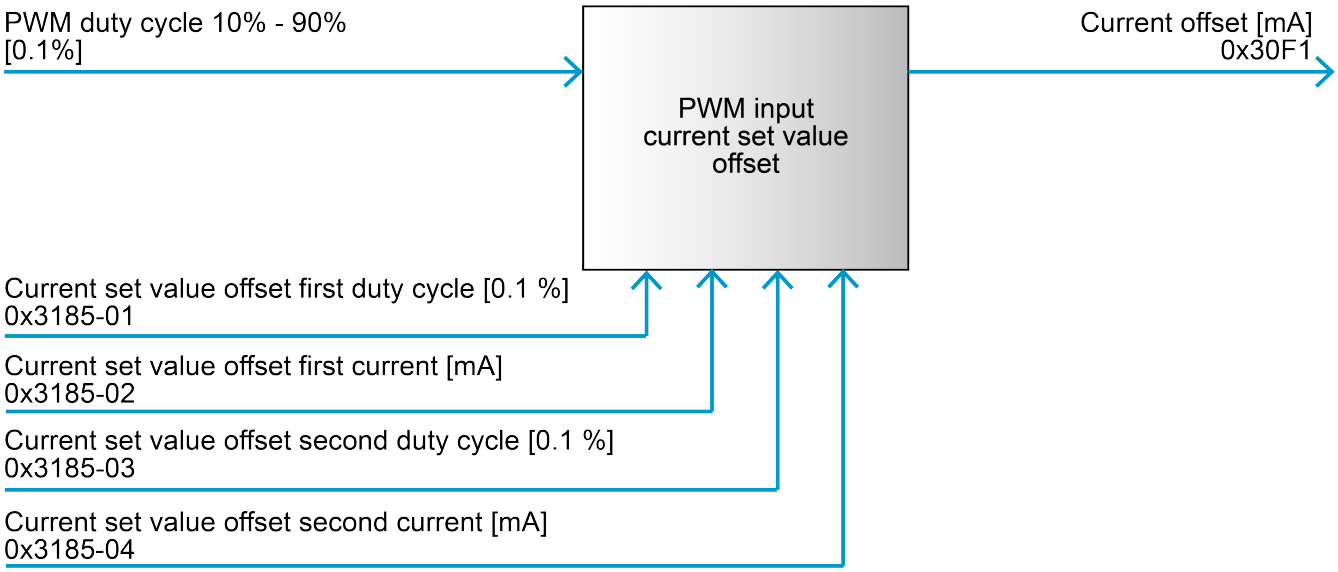

Figure 28. Digital input PWM current set value offset scaling – Set value function

Name	Digital input PWM current set value offset scaling
Index	0x3185
Object code	RECORD
Highest subindex supported	4

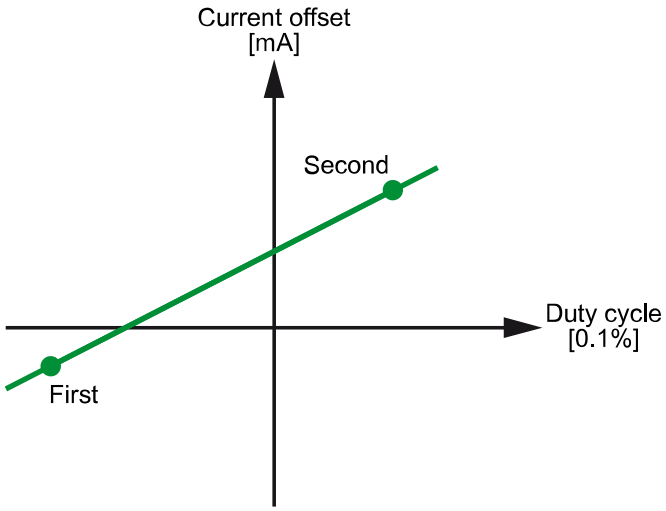

Figure 29. Digital input PWM current set value offset scaling – Set value

6.2.78.1. Current set value offset first duty cycle

This object represents the set duty cycle for the first slope point. The value is given in [0.1 %].

Name	Current set value offset first duty cycle	
Index	0x3185	
Subindex	0x01	
Data type	INTEGER32	
Access type	RW	
Default value	100	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.78.2. Current set value offset first current

This object represents the output current for the first slope point. The value is given in [mA].

Name	Current set value offset first current	
Index	0x3185	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.78.3. Current set value offset second duty cycle

This object represents the set duty cycle for the second slope point. The value is given in [0.1 %].

Name	Current set value offset second duty cycle

Index	0x3185	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	900	
Value range	100	900
PDO mapping	NO	
Persistent	YES	

6.2.78.4. Current set value offset second current

This object represents the output current for the second slope point. The value is given in [mA].

Name	Current set value offset second current	
Index	0x3185	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.79. Analog input velocity set value scaling

A set value function for the analog input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the velocity set value, which is set by an analog input value. Invalid scaling settings (first and second voltage identical) results in the first velocity being used (Velocity set value first velocity). The functionality is supported in I/O Velocity Mode (IOVM).

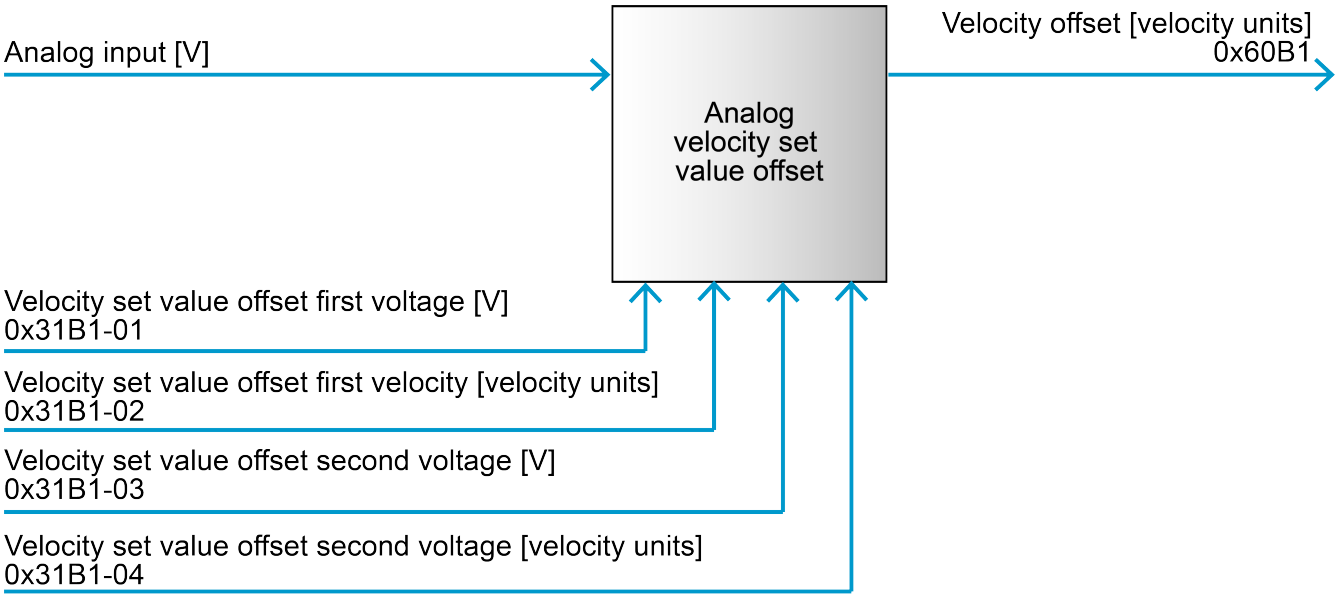

Figure 30. Analog input velocity set value scaling – Set value function

Name	Analog input velocity set value scaling
Index	0x31B0
Object code	RECORD
Highest subindex supported	4

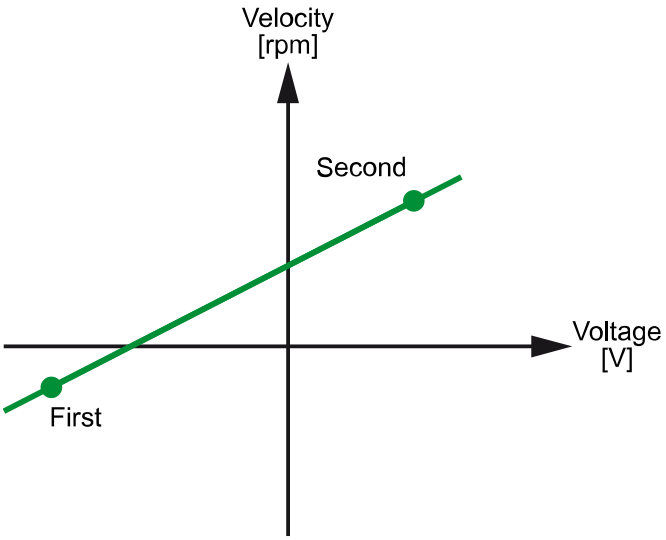

Figure 31. Analog input velocity set value scaling – Set value

6.2.79.1. Velocity set value first voltage

This object represents the set voltage for the first slope point. The value is given in [mV].

Name	Velocity set value first voltage
Index	0x31B0
Subindex	0x01
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value first slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV
ESCON2 Micro 60/5	-10'000mV
ESCON2 Nano 24/2	0mV

Table 105. Analog In - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV	10'000mV
ESCON2 Micro 60/5	-10'000mV	10'000mV
ESCON2 Nano 24/2	0mV	5'000mV

Table 106. Analog In - value range

6.2.79.2. Velocity set value first velocity

This object represents the set velocity for the first slope point. The value is given in [velocity units].

Name	Velocity set value first velocity	
Index	0x31B0	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.79.3. Velocity set value second voltage

This object represents the set voltage for the second slope point. The value is given in [mV].

Name	Velocity set value second voltage
Index	0x31B0
Subindex	0x03
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value second slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	10'000mV
ESCON2 Micro 60/5	10'000mV
ESCON2 Nano 24/2	5'000mV

Table 107. Analog In - default value second slope point

6.2.79.4. Velocity set value second velocity

This object represents the set velocity for the second slope point. The value is given in [velocity units].

Name	Velocity set value second velocity
Index	0x31B0
Subindex	0x04
Data type	INTEGER32
Access type	RW
Default value	0

Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.80. Analog input velocity set value offset scaling

A set value function for the analog input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the velocity set value offset which is set by an analog input value. Invalid scaling settings (first and second voltage identical) results in the first velocity set value offset being used (Velocity set value offset first velocity). The functionality is supported in I/O Velocity Mode (IOVM).

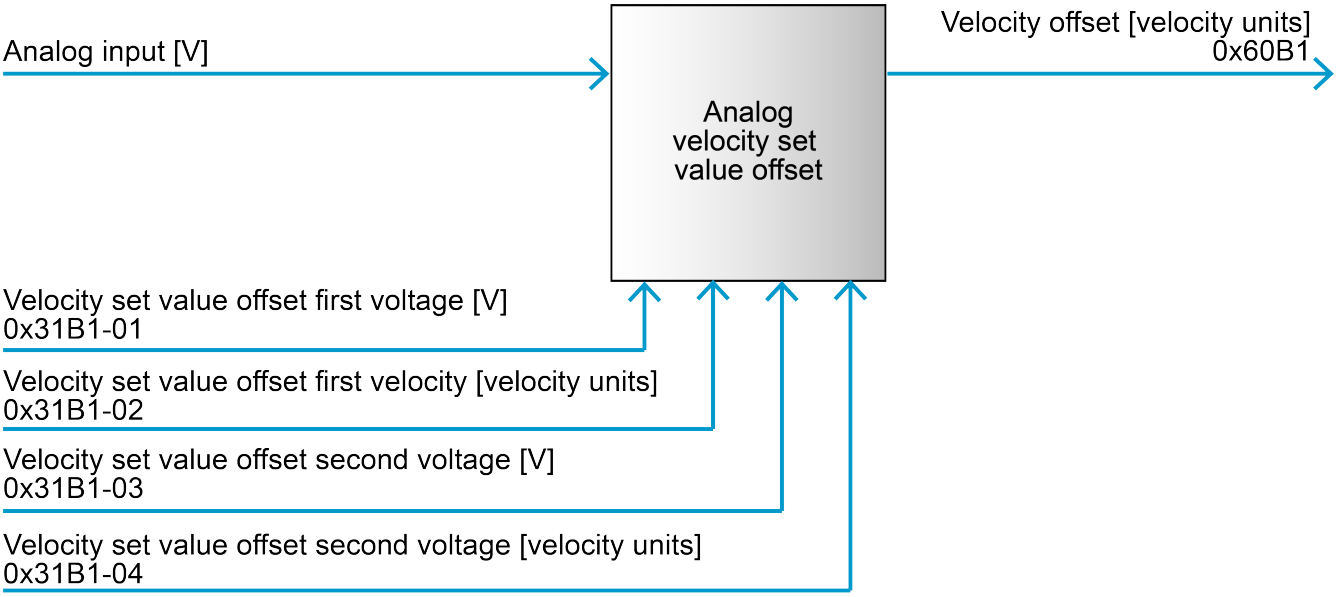

Figure 32. Analog input velocity set value offset scaling – Set value function

Name	Analog input velocity set value offset scaling
Index	0x31B1
Object code	RECORD
Highest subindex supported	4

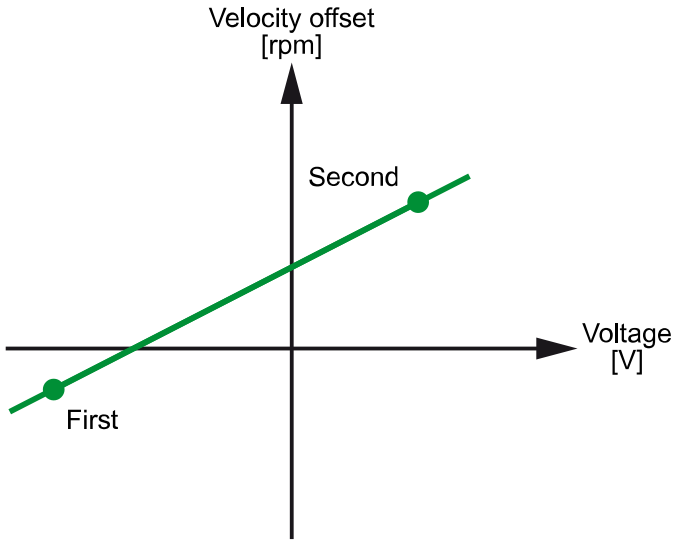

Figure 33. Analog input velocity set value offset scaling – Set value

6.2.80.1. Velocity set value offset first voltage

This object represents the set voltage for the first slope point. The value is given in [mV].

Name	Velocity set value offset first voltage
Index	0x31B1
Subindex	0x01
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value first slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV
ESCON2 Micro 60/5	-10'000mV
ESCON2 Nano 24/2	0mV

Table 108. Analog In - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV	10'000mV
ESCON2 Micro 60/5	-10'000mV	10'000mV
ESCON2 Nano 24/2	0mV	5'000mV

Table 109. Analog In - value range

6.2.80.2. Velocity set value offset first velocity

This object represents the set velocity for the first slope point. The value is given in [velocity units].

Name	Velocity set value offset first velocity	
Index	0x31B1	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.80.3. Velocity set value offset second voltage

This object represents the set voltage for the second slope point. The value is given in [mV].

Name	Velocity set value offset second voltage
Index	0x31B1

Subindex	0x03
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value second slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	10'000mV
ESCON2 Micro 60/5	10'000mV
ESCON2 Nano 24/2	5'000mV

Table 110. Analog In - default value second slope point

6.2.80.4. Velocity set value offset second velocity

This object represents the set velocity for the second slope point. The value is given in [velocity units].

Name	Velocity set value offset second velocity	
Index	0x31B1	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- 120'000 rpm	+ 120'000 rpm
PDO mapping	NO	
Persistent	YES	

6.2.81. Analog input current set value scaling

A set value function for the analog input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the current set value, which is set by an analog input value. Invalid scaling settings (first and second voltage identical) results in the first current being used (Current set value first current). The functionality is supported in I/O Current Mode (IOCM).

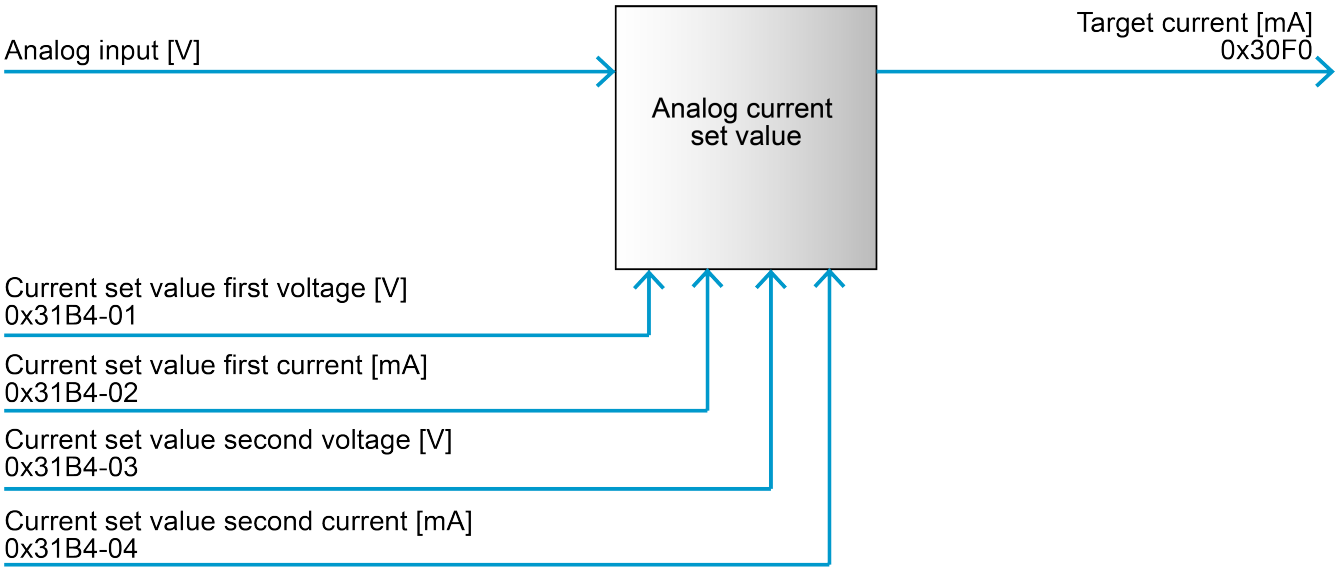

Figure 34. Analog input current set value scaling – Set value function

Name	Analog input current set value scaling
Index	0x31B4
Object code	RECORD
Highest subindex supported	4

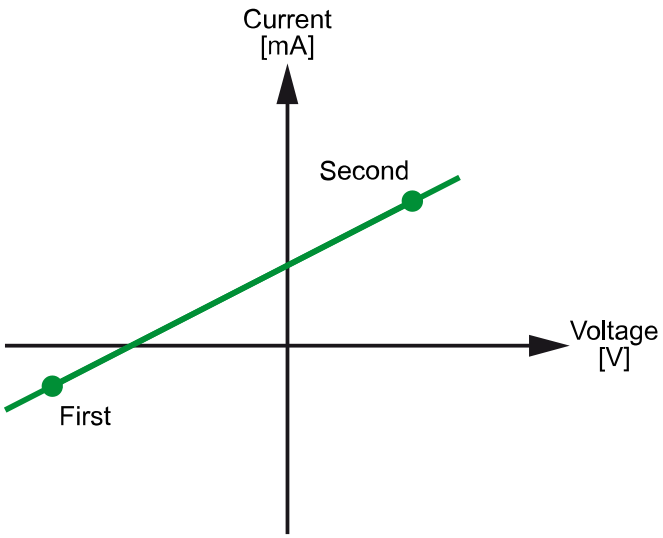

Figure 35. Analog input current set value scaling – Set value

6.2.81.1. Current set value first voltage

This object represents the set voltage for the first slope point. The value is given in [mV].

Name	Current set value first voltage
Index	0x31B4
Subindex	0x01
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value first slope point

Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV
ESCON2 Micro 60/5	-10'000mV
ESCON2 Nano 24/2	0mV

Table 111. Analog In - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV	10'000mV
ESCON2 Micro 60/5	-10'000mV	10'000mV
ESCON2 Nano 24/2	0mV	5'000mV

Table 112. Analog In - value range

6.2.81.2. Current set value first current

This object represents the output current for the first slope point. The value is given in [mA].

Name	Current set value first current	
Index	0x31B4	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.81.3. Current set value second voltage

This object represents the set voltage for the second slope point. The value is given in [mV].

Name	Current set value second voltage
Index	0x31B4
Subindex	0x03
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value second slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	10'000mV
ESCON2 Micro 60/5	10'000mV
ESCON2 Nano 24/2	5'000mV

Table 113. Analog In - default value second slope point

6.2.81.4. Current set value second current

This object represents the output current for the second slope point. The value is given in [mA].

Name	Current set value second current	
Index	0x31B4	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.82. Analog input current set value offset scaling

A set value function for the analog input. Write access is only permitted in device state «Power Disable» (see Device control). It configures the current set value offset which is set by an analog input value. Invalid scaling settings (first and second voltage identical) results in the first current set value offset being used (Current set value offset first current). The functionality is supported in I/O Current Mode (IOCM).

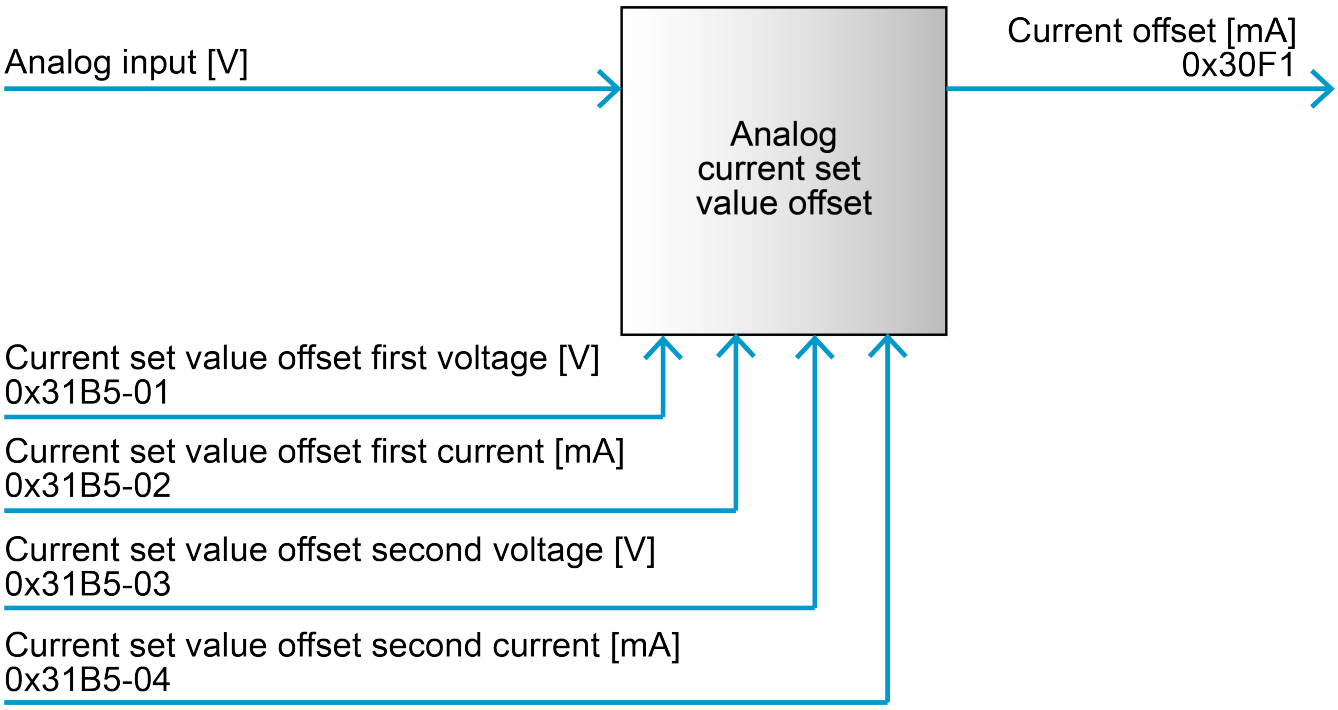

Figure 36. Analog input current set value offset scaling – Set value function

Name	Analog input current set value offset scaling

Index	0x31B5
Object code	RECORD
Highest subindex supported	4

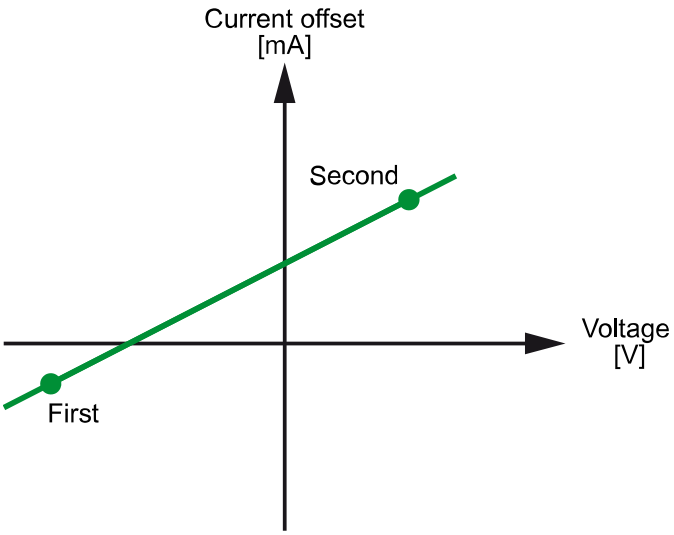

Figure 37. Analog input current set value offset scaling – Set value

6.2.82.1. Current set value offset first voltage

Represents the set voltage for the first slope point. The value is given in [mV].

Name	Current set value offset first voltage
Index	0x31B5
Subindex	0x01
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value first slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV
ESCON2 Micro 60/5	-10'000mV
ESCON2 Nano 24/2	0mV

Table 114. Analog In - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-10'000mV	10'000mV
ESCON2 Micro 60/5	-10'000mV	10'000mV
ESCON2 Nano 24/2	0mV	5'000mV

Table 115. Analog In - value range

6.2.82.2. Current set value offset first current

This object represents the output current for the first slope point. The value is given in [mA].

Name	Current set value offset first current	
Index	0x31B5	
Subindex	0x02	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	
Persistent	YES	

6.2.82.3. Current set value offset second voltage

This object represents the set voltage for the second slope point. The value is given in [mV].

Name	Current set value offset second voltage
Index	0x31B5
Subindex	0x03
Data type	INTEGER32
Access type	RW
Default value	Analog In - default value second slope point
Value range	Analog In - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	10'000mV
ESCON2 Micro 60/5	10'000mV
ESCON2 Nano 24/2	5'000mV

Table 116. Analog In - default value second slope point

6.2.82.4. Current set value offset second current

This object represents the output current for the second slope point. The value is given in [mA].

Name	Current set value offset second current	
Index	0x31B5	
Subindex	0x04	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	- Max Output current limit	+ Max Output current limit
PDO mapping	NO	

Persistent	YES

6.2.83. Analog output velocity scaling

Configures how Velocity actual value and Velocity actual value averaged are scaled for analog output monitoring. Write access is only permitted in device state «Power Disable» (see Device control). Invalid scaling settings (first and second values identical) will output the voltage configured in Velocity actual first voltage.
Related objects: Velocity actual value, Velocity actual value averaged, Configuration of analog outputs

Name	Analog output velocity scaling
Index	0x31C1
Object code	RECORD
Highest subindex supported	4

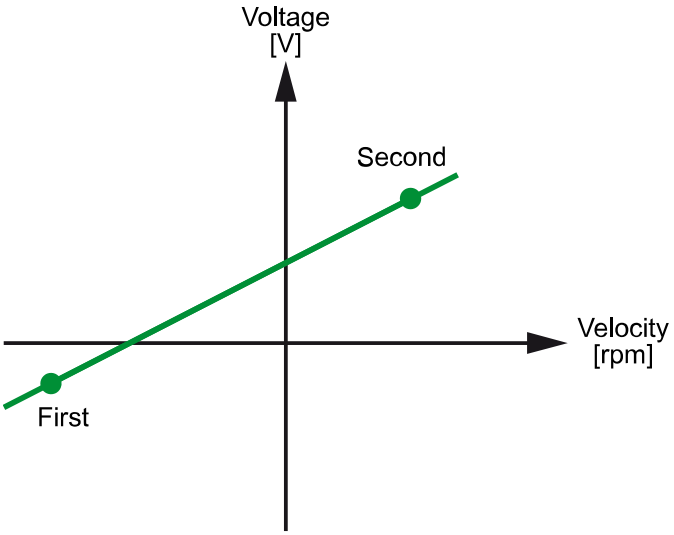

Figure 38. Analog output velocity monitor scaling

6.2.83.1. Velocity actual first velocity

This object represents the velocity value for the first slope point. The value is given in [velocity units].

Name	Velocity actual first velocity	
Index	0x31C1	
Subindex	0x01	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.83.2. Velocity actual first voltage

This object represents the output voltage for the first slope point. The value is given in [mV].

Name	Velocity actual first voltage

Index	0x31C1
Subindex	0x02
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value first slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV
ESCON2 Micro 60/5	-4'000mV
ESCON2 Nano 24/2	0mV

Table 117. Analog Out - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV	4'000mV
ESCON2 Micro 60/5	-4'000mV	4'000mV
ESCON2 Nano 24/2	0mV	3'300mV

Table 118. Analog Out - value range

6.2.83.3. Velocity actual second velocity

This object represents the velocity value for the second slope point. The value is given in [velocity units].

Name	Velocity actual second velocity	
Index	0x31C1	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.83.4. Velocity actual second voltage

This object represents the output voltage for the second slope point. The value is given in [mV].

Name	Velocity actual second voltage
Index	0x31C1
Subindex	0x04
Data type	INTEGER32
Access type	RW

Default value	Analog Out - default value second slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	4'000mV
ESCON2 Micro 60/5	4'000mV
ESCON2 Nano 24/2	3'300mV

Table 119. Analog Out - default value second slope point

6.2.84. Analog output current scaling

Configures how Current actual value averaged and Current actual value are scaled for analog output monitoring. Write access is only permitted in device state «Power Disable» (see Device control). Invalid scaling settings (first and second value identical) will output the voltage configured in Current actual first voltage.
Related objects: Current actual value averaged, Current actual value, Configuration of analog outputs

Name	Analog output current scaling
Index	0x31C2
Object code	RECORD
Highest subindex supported	4

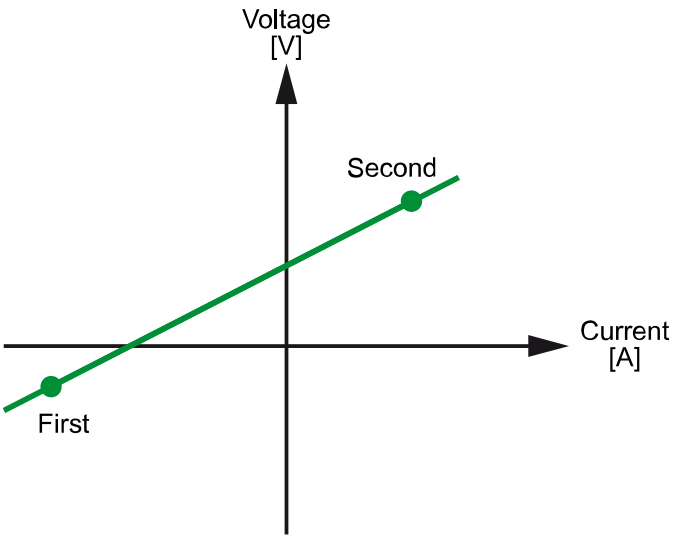

Figure 39. Analog output current monitor scaling

6.2.84.1. Current actual first current

This object represents the current value for the first slope point. The value is given in [mA].

Name	Current actual first current
Index	0x31C2
Subindex	0x01
Data type	INTEGER32
Access type	RW

Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.84.2. Current actual first voltage

This object represents the output voltage for the first slope point. The value is given in [mV].

Name	Current actual first voltage
Index	0x31C2
Subindex	0x02
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value first slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV
ESCON2 Micro 60/5	-4'000mV
ESCON2 Nano 24/2	0mV

Table 120. Analog Out - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV	4'000mV
ESCON2 Micro 60/5	-4'000mV	4'000mV
ESCON2 Nano 24/2	0mV	3'300mV

Table 121. Analog Out - value range

6.2.84.3. Current actual second current

This object represents the current value for the second slope point. The value is given in [mA].

Name	Current actual second current	
Index	0x31C2	
Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.84.4. Current actual second voltage

This object represents the output voltage for the second slope point. The value is given in [mV].

Name	Current actual second voltage
Index	0x31C2
Subindex	0x04
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value second slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	4'000mV
ESCON2 Micro 60/5	4'000mV
ESCON2 Nano 24/2	3'300mV

Table 122. Analog Out - default value second slope point

6.2.85. Analog output temperature scaling

Configures how Temperature logic section and Temperature power stage are scaled for analog output monitoring. Write access is only permitted in device state «Power Disable» (see Device control). Invalid scaling settings (first and second values identical) will output the voltage configured in Logic section temperature first voltage or Power stage temperature first voltage respectively.
Related objects: Temperature logic section, Temperature power stage, Configuration of analog outputs

Name	Analog output temperature scaling
Index	0x31C3
Object code	RECORD
Highest subindex supported	8

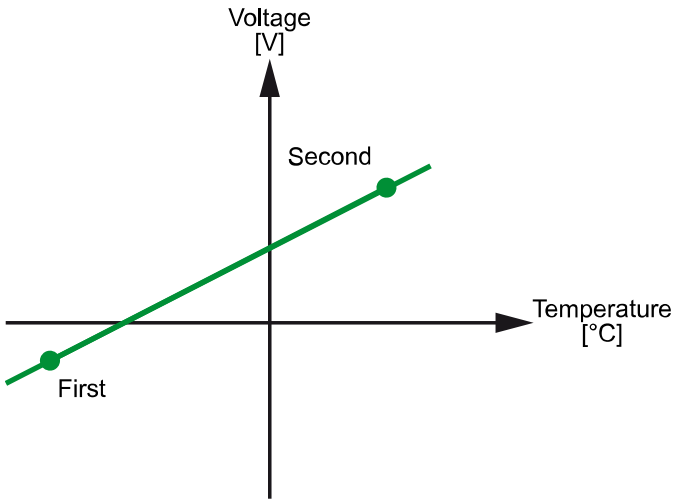

Figure 40. Analog output temperature monitor scaling

6.2.85.1. Logic section temperature first temperature

This object represents the temperature value for the first slope point. The value is given in [0.1 °C].

Name	Logic section temperature first temperature	
Index	0x31C3	
Subindex	0x01	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.85.2. Logic section temperature first voltage

This object represents the output voltage for the first slope point. The value is given in [mV].

Name	Logic section temperature first voltage
Index	0x31C3
Subindex	0x02
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value first slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV
ESCON2 Micro 60/5	-4'000mV
ESCON2 Nano 24/2	0mV

Table 123. Analog Out - default value first slope point

Hardware	Lower Limit	Upper Limit
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV	4'000mV
ESCON2 Micro 60/5	-4'000mV	4'000mV
ESCON2 Nano 24/2	0mV	3'300mV

Table 124. Analog Out - value range

6.2.85.3. Logic section temperature second temperature

This object represents the temperature value for the second slope point. The value is given in [0.1 °C].

Name	Logic section temperature second temperature
Index	0x31C3

Subindex	0x03	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.85.4. Logic section temperature second voltage

This object represents the output voltage for the second slope point. The value is given in [mV].

Name	Logic section temperature second voltage
Index	0x31C3
Subindex	0x04
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value second slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	4'000mV
ESCON2 Micro 60/5	4'000mV
ESCON2 Nano 24/2	3'300mV

Table 125. Analog Out - default value second slope point

6.2.85.5. Power stage temperature first temperature

This object represents the temperature value for the first slope point. The value is given in [0.1 °C].

Name	Power stage temperature first temperature	
Index	0x31C3	
Subindex	0x05	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.85.6. Power stage temperature first voltage

This object represents the output voltage for the first slope point. The value is given in [mV].

Name	Power stage temperature first voltage
Index	0x31C3
Subindex	0x06
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value first slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	-4'000mV
ESCON2 Micro 60/5	-4'000mV
ESCON2 Nano 24/2	0mV

Table 126. Analog Out - default value first slope point

6.2.85.7. Power stage temperature second temperature

This object represents the temperature value for the second slope point. The value is given in [0.1 °C].

Name	Power stage temperature second temperature	
Index	0x31C3	
Subindex	0x07	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	YES	

6.2.85.8. Power stage temperature second voltage

This object represents the output voltage for the second slope point. The value is given in [mV].

Name	Power stage temperature second voltage
Index	0x31C3
Subindex	0x08
Data type	INTEGER32
Access type	RW
Default value	Analog Out - default value second slope point
Value range	Analog Out - value range
PDO mapping	NO
Persistent	YES

Hardware	Default
ESCON2 Module 60/30 ESCON2 Compact 60/30	4'000mV
ESCON2 Micro 60/5	4'000mV
ESCON2 Nano 24/2	3'300mV

Table 127. Analog Out - default value second slope point

6.2.86. Thermal protection motor

This object represents the model-based I2t power limitation parameters.

Name	Thermal protection motor
Index	0x3200
Object code	RECORD
Highest subindex supported	1

6.2.86.1. I2t level motor

Provides the actual thermal state of the internal I2t motor protection feature. The number is given in percent, values higher than 100% are possible.

Name	I2t level motor
Index	0x3200
Subindex	0x01
Data type	UNSIGNED16
Access type	RO
Default value	-
Value range	-
PDO mapping	TXPDO
Persistent	NO

6.2.87. Thermal protection power stage

Limits output current based on power stage temperature and I2t model. The smaller of the two output values is used as the limit after accounting for both values.

Note:	
	For ESCON2 Nano 24/2, the output current is limited based only on the power stage temperature; the I2t model is not used.

Name	Thermal protection power stage
Index	0x3201
Object code	RECORD
Highest subindex supported	3

6.2.87.1. I2t level power stage

Provides the actual thermal state of the internal I2t power stage protection feature. The number is given in

percent, values higher than 100% are possible.

Name	I2t level power stage
Index	0x3201
Subindex	0x01
Data type	UNSIGNED16
Access type	RO
Default value	-
Value range	-
PDO mapping	TXPDO
Persistent	NO

6.2.87.2. Temperature power stage

This object displays the power stage temperature. The value is given in [0.1 °C].

From the warning temperature, the maximum permissable current (Max current) is linearly reduced with increasing temperature up to the maximum temperature. The Thermal power stage overload warning cannot be removed while restrictions are in effect. Once the temperature drops below the warning threshold, it will automatically be cleared. Upon reaching the upper limit, Thermal power stage overload error is set, which disables the device.

Name	Temperature power stage	
Index	0x3201	
Subindex	0x02	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Hardware	Warning	Disable	Max Current
ESCON2 Module 60/30 ESCON2 Compact 60/30	Max temperature power stage - 10°C	Max temperature power stage	60'000mA
ESCON2 Micro 60/5	Max temperature power stage - 10°C	Max temperature power stage	15'000mA
ESCON2 Nano 24/2	Max temperature power stage - 10°C	Max temperature power stage	6'000mA

Table 128. Temperature power stage - Temperature limits

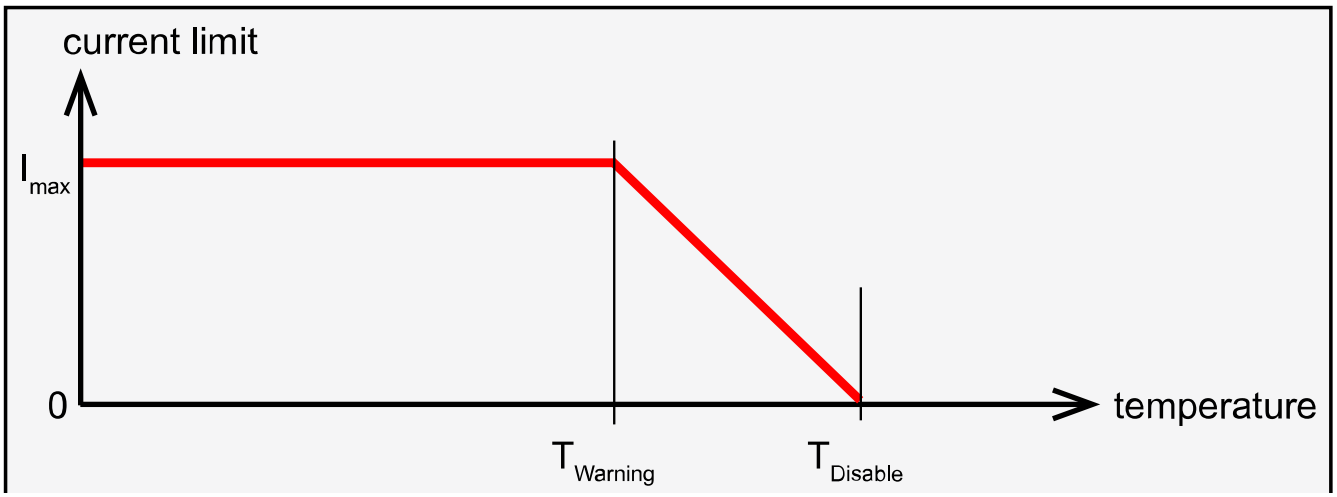

Figure 41. Current derating principle

6.2.87.3. Max temperature power stage

Maximum power stage temperature [0.1 °C]. The power stage is turned off when Temperature power stage reaches this level.

Name	Max temperature power stage
Index	0x3201
Subindex	0x03
Data type	UNSIGNED16
Access type	RW
Default value	Max temperature power stage
Value range	Max temperature power stage
PDO mapping	NO
Persistent	YES

Hardware	Default	Min	Max
ESCON2 Module 60/30 ESCON2 Compact 60/30	110°C	0°C	110°C
ESCON2 Micro 60/5	100°C	0°C	100°C
ESCON2 Nano 24/2	90°C	0°C	90°C

Table 129. Max temperature power stage

6.2.88. Motor control

Handles the motor control.

Name	Motor control
Index	0x3203
Object code	RECORD
Highest subindex supported	1

6.2.88.1. Power stage output level actual value

Displays the actual output level of the power stage in relation to the available supply voltage. The value is given

in [0.1%].
If the value reaches the Power stage max output level the limitation bit in Statusword will be set.
Related object: Statusword

Name	Power stage output level actual value	
Index	0x3203	
Subindex	0x01	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Hardware	Max
ESCON2 Module 60/30 ESCON2 Compact 60/30	950 [0.1%]
ESCON2 Micro 60/5	950 [0.1%]
ESCON2 Nano 24/2	900 [0.1%]

Table 130. Power stage max output level

6.2.89. Abort connection option code

This object specifies the action that will be performed when one of the errors labeled "a" (see Device errors) is detected.
Related object: Quick stop deceleration

Name	Abort connection option code
Index	0x6007
Subindex	0x00
Data type	INTEGER16
Access type	RW
Default value	-3
Value range	Abort connection option code
PDO mapping	NO
Persistent	YES

Value	Description
-3	Slow down with quick-stop ramp; disable the drive function

Table 131. Abort connection option code

6.2.90. Error code

This object provides the error code of the last error or warning that occurred in the device. A non-erasable error takes priority over an erasable error, and an erasable error takes priority over a warning. The error code of a warning is only shown in this object while the warning is active. The object Error history contains a detailed list of the errors. This value is different from the value in Error register.

Name	Error code	
Index	0x603F	
Subindex	0x00	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.91. Controlword

Comprises bits for the following items:

- Device control commands (bits 0…3, 7)
- Supervision of operating modes (bits 4…6, 8):
  - Profile Velocity Mode - Controlword

For bit patterns of triggered commands, see Device control commands
Related object: Statusword

Name	Controlword	
Index	0x6040	
Subindex	0x00	
Data type	UNSIGNED16	
Access type	RW	
Default value	-	
Value range	-	-
PDO mapping	RXPDO	
Persistent	NO	

Bit	Description	IOVM/CSV	IOCM/CST	PVM
15	Operating mode-specific	Reserved	Reserved	Reserved
14… 11	Reserved			
10, 9	Reserved			
8	Operating mode-specific			Halt
7	Fault reset			
6	Operating mode-specific			Reserved
5	Operating mode-specific			Reserved
4	Operating mode-specific			Reserved
3	Enable operation			
2	Quick stop			
1	Enabled voltage			
0	Switched on			

Table 132. Controlword bits

6.2.92. Statusword

Comprises bits for the following items:

- State of the drive
- Operating state of the mode (bits 10, 12, and 13):
  - Statusword (I/O Velocity Mode - Specific Bits)
  - Statusword (I/O Current Mode - Specific bits)
  - Statusword (Profile Velocity Mode - Specific bits)
  - Statusword (Cyclic Synchronous Velocity Mode - Specific bits)
  - Statusword (Cyclic Synchronous Torque Mode - Specific bits)
- Remote (bit 9: NMT state is operational)
- Internal limit active, see velocity-based Limits and current-based Limits
- Warning (bit 7: indicates the presence of a warning condition)

Related object: Controlword.

Name	Statusword	
Index	0x6041	
Subindex	0x00	
Data type	UNSIGNED16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Bit	Description	IOVM/CSV	IOCM/CST	PVM
15	Reserved			
14	Reserved			
13	Operating mode-specific			Not used
12	Operating mode-specific	Drive follows command value	Drive follows command value	Speed
11	Internal limit active	I2t, Current, Max motor speed, Power stage output level	I2t, Current, Max motor speed, Power stage output level	I2t, Current, Max velocity, Power stage output level
10	Operating mode-specific	Reserved	Reserved	Target reached
9	Remote			
8	Reserved (0)			
7	Warning			
6	Switch on disabled			
5	Quick stop			
4	Voltage enabled (power stage on)			
3	Fault			
2	Operation enabled			

Bit	Description	IOVM/CSV	IOCM/CST	PVM
1	Switched on			
0	Ready to switch on			

Table 133. Statusword bits

6.2.93. Quick stop option code

This object indicates the action that will be performed when «Quick stop» is executed (see Device control).
Related object: Quick stop deceleration

Name	Quick stop option code
Index	0x605A
Subindex	0x00
Data type	INTEGER16
Access type	RW
Default value	6
Value range	Quick stop option code
PDO mapping	NO
Persistent	YES

Value	Description
6	Slow down with quick-stop ramp and stay in Quick stop active (power stage remains enabled)

Table 134. Quick stop option code

6.2.94. Shutdown option code

This object indicates the action that will be performed during transition from state «Operation enabled» to state «Ready to switch on» (see Device control).

Name	Shutdown option code
Index	0x605B
Subindex	0x00
Data type	INTEGER16
Access type	RW
Default value	0
Value range	Shutdown option code
PDO mapping	NO
Persistent	YES

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

Table 135. Shutdown option code

6.2.95. Disable operation option code

This object indicates the action that will be performed during transition from state «Operation enabled» to state «Switched on» (see Device control). The slow-down ramp is the deceleration value of the used mode of operation.

Related object: Profile deceleration, Quick stop deceleration

Name	Disable operation option code
Index	0x605C
Subindex	0x00
Data type	INTEGER16
Access type	RW
Default value	1
Value range	Disable operation option code
PDO mapping	NO
Persistent	YES

Value	Description
1	Slow down with slow-down ramp; disable the drive function

Table 136. Disable operation option code

6.2.96. Halt option code

This object indicates the action that will be performed when the halt function is executed. The slow-down ramp is the deceleration value of the used mode of operation.
Related object: Profile deceleration

Name	Halt option code
Index	0x605D
Subindex	0x00
Data type	INTEGER16
Access type	RW
Default value	1
Value range	Halt option code
PDO mapping	NO
Persistent	YES

Value	Description
1	Slow down with slow-down ramp and stay in operation enabled

Table 137. Halt option code

6.2.97. Fault reaction option code

This object specifies the action that will be performed when one of the errors labeled "f" (see Device errors) is detected.
Related object: Quick stop deceleration

Name	Fault reaction option code
Index	0x605E
Subindex	0x00
Data type	INTEGER16
Access type	RW

Default value	2
Value range	Fault reaction option code
PDO mapping	NO
Persistent	YES

Value	Description
2	Slow down with quick-stop ramp; disable the drive function

Table 138. Fault reaction option code

6.2.98. Modes of operation

This object switches the currently selected operating mode. We recommend using Modes of operation display after changing the operating mode.
Related object: Modes of operation display.

Name	Modes of operation
Index	0x6060
Subindex	0x00
Data type	INTEGER8
Access type	RW
Default value	-121
Value range	Modes of operation
PDO mapping	RXPDO
Persistent	YES

Operation mode	Description
3	Profile Velocity Mode (PVM)
9	Cyclic Synchronous Velocity Mode (CSV)
10	Cyclic Synchronous Torque Mode (CST)
-121	I/O Velocity Mode (IOVM)
-120	I/O Current Mode (IOCM)

Table 139. Modes of operation

6.2.99. Modes of operation display

This object shows the current mode of operation. The meaning of the returned value corresponds to the code in Modes of operation.
Related object: Modes of operation.

Name	Modes of operation display
Index	0x6061
Subindex	0x00
Data type	INTEGER8
Access type	RO
Default value	-
Value range	Modes of operation

PDO mapping	TXPDO
Persistent	NO

6.2.100. Velocity demand value

This object is used as input for the velocity controller. The value is given in [velocity units].

Name	Velocity demand value	
Index	0x606B	
Subindex	0x00	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.101. Velocity actual value

This object provides the actual velocity value of the axis, derived from the main sensor defined in Axis configuration. If no main sensor is configured, an estimated velocity is displayed. The value is given in [velocity units].
Related objects: Velocity actual values, Additional velocity actual values.

Name	Velocity actual value	
Index	0x606C	
Subindex	0x00	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.102. Target torque

This object indicates the configured input value for the torque controller in Cyclic Synchronous Torque Mode (CST). The value is given in permill [‰] of Motor rated torque.
Related object: Motor rated torque.

Name	Target torque	
Index	0x6071	
Subindex	0x00	
Data type	INTEGER16	
Access type	RW	
Default value	0	
Value range	-	-

PDO mapping	RXPDO
Persistent	NO

6.2.103. Motor rated torque

This object holds the value to which all torque objects are related. Changing the value has no effect. The value will be overwritten with Nominal current multiplied by Torque constant.
The value is given in [µNm].
Related object: Motor data.

Name	Motor rated torque	
Index	0x6076	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	NO	
Persistent	NO	

6.2.104. Torque actual value

This object provides the actual torque and corresponds to the motor's instantaneous torque. The value is given in permill [‰] of Motor rated torque.
Related object: Motor rated torque.

Name	Torque actual value	
Index	0x6077	
Subindex	0x00	
Data type	INTEGER16	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.105. Max profile velocity

This object is used as a velocity limit in regulation tuning.
This object is used as a velocity limit in Profile Velocity Mode (PVM).
Related objects: Max motor speed, Target velocity
The value is given in [velocity units].

Name	Max profile velocity
Index	0x607F
Subindex	0x00
Data type	UNSIGNED32
Access type	RW

Default value	120'000	
Value range	1	Max motor speed
PDO mapping	RXPDO	
Persistent	YES	

6.2.106. Max motor speed

This object indicates the configured maximum allowed speed for the motor. It serves as protection for the motor. The value is given in [rpm]. For detailed motor specifications, refer to the maxon catalog.

Related objects:

- Motor type
- Number of pole pairs
- Target velocity

Name	Max motor speed
Index	0x6080
Subindex	0x00
Data type	UNSIGNED32
Access type	RW
Default value	120'000
Value range	Max motor speed values
PDO mapping	RXPDO
Persistent	YES

Motor type	Description	Maximum speed [rpm]
1	Brushed DC motor (maxon DC motor)	120'000
10	Brushless DC motor (maxon EC motor/BLDC motor), sinus commutated	120'000 / number of pole pairs

Table 140. Max motor speed values

6.2.107. Profile acceleration

This object defines the acceleration value used during a profiled move. The value is given in [acceleration units]. Supported modes are I/O Velocity Mode (IOVM) and Profile Velocity Mode (PVM).

Name	Profile acceleration	
Index	0x6083	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	10'000	
Value range	1	Max acceleration
PDO mapping	RXPDO	
Persistent	YES	

6.2.108. Profile deceleration

This object defines the deceleration value used during a profiled move.
The value is given in [acceleration units].
Supported modes are I/O Velocity Mode (IOVM) and Profile Velocity Mode (PVM).

Name	Profile deceleration	
Index	0x6084	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	10'000	
Value range	1	Max acceleration
PDO mapping	RXPDO	
Persistent	YES	

6.2.109. Quick stop deceleration

This object determines the deceleration of the quick stop profile.
Is also be used with a «quick stop» command (see Device control commands).
The value is given in [acceleration units].

Related objects:

- Controlword
- Abort connection option code
- Quick stop option code
- Disable operation option code
- Fault reaction option code

Name	Quick stop deceleration	
Index	0x6085	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	10'000	
Value range	1	Max acceleration
PDO mapping	RXPDO	
Persistent	YES	

6.2.110. Motion profile type

This object selects the type of motion profile trajectory used in Profile Velocity Mode (PVM).

Name	Motion profile type
Index	0x6086
Subindex	0x00
Data type	INTEGER16

Access type	RW
Default value	0
Value range	Motion Profile Types
PDO mapping	RXPDO
Persistent	YES

Value	Description
0	linear ramp (trapezoidal profile)

Table 141. Motion Profile Types

6.2.111. SI unit velocity

This object defines the velocity units. The coding of the user-defined units and prefixes follows System units.

Write access is only permitted in the device state «Power Disable» Device control.

Name	SI unit velocity
Index	0x60A9
Subindex	0x00
Data type	UNSIGNED32
Access type	RW
Default value	0x00B44700
Value range	SI Units Velocity - value range
PDO mapping	NO
Persistent	YES

Bit 31…24	Bit 24…16	Bit 15…8	Bit 7…0
Prefix	Numerator	Denominator	Reserved(0)

Table 142. SI Units Velocity - Bits

Value	Description	Symbol
0x00B44700	Revolutions/minute	rev/min [rpm]
0xFDB44700	0.001 revolutions/minute	milli rev/min [mrpm]

Table 143. SI Units Velocity - value range

6.2.112. SI unit acceleration

This object defines the acceleration units. The coding of the user-defined units and prefixes follows System units.

Write access is only permitted in the device state «Power Disable» Device control.

Name	SI unit acceleration
Index	0x60AA
Subindex	0x00
Data type	UNSIGNED32
Access type	RW
Default value	0x00C00300

Value range	SI Units Acceleration - value range
PDO mapping	NO
Persistent	YES

Bit 31…24	Bit 24…16	Bit 15…8	Bit 7…0
Prefix	Numerator	Denominator	Reserved(0)

Table 144. SI Units Acceleration - Bits

Value	Description	Symbol
0x00C00300	(Revolutions/minute)/second	rpm/s

Table 145. SI Units Acceleration - value range

6.2.113. Velocity offset

The velocity offset value is internally added to the Target velocity. The value is given in [velocity units]. Supported modes are I/O Velocity Mode (IOVM) and Cyclic Synchronous Velocity Mode (CSV).

Name	Velocity offset	
Index	0x60B1	
Subindex	0x00	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	RXPDO	
Persistent	NO	

6.2.114. Torque offset

The torque offset value is internally added to the Target torque. The value is given in [0.1 %]. Supported modes are Cyclic Synchronous Torque Mode (CST) and Cyclic Synchronous Velocity Mode (CSV).

Name	Torque offset	
Index	0x60B2	
Subindex	0x00	
Data type	INTEGER16	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	RXPDO	
Persistent	NO	

6.2.115. Interpolation time period

This object indicates the interpolation time for set values in synchronous modes with PDO. Values greater than 0 enable demand value interpolation in CSV mode. It is important that the set values (Velocity offset, Target velocity) is written cyclically with the interpolation time period. If no new value (specifically, SYNC PDO) is received within a time of 3 times the interpolation value, the error CAN PDO timeout is triggered.

The value is given in milliseconds [ms]. A value of '0' disables the interpolation.

Best Practice:	
	The interpolation time period must be configured to match the master's synchronized PDO command cycle that updates the CSV set value. If a value of '0' is configured, the device immediately takes the new set value and adjusts the velocity within the next control cycle (approximately 0.1 ms). It then holds this set value until the next set value from the master is received. This can cause interruptions and noisy motion if the master provides new set values at cycle rates of 1 ms, 2 ms, or longer. If the interpolation time period is configured correctly based on the master's PDO cycle time, the device will interpolate the new set value within this period. This results in smooth motion and a less noisy control outcome.

Name	Interpolation time period
Index	0x60C2
Object code	RECORD
Highest subindex supported	2

6.2.115.1. Interpolation time period value

Name	Interpolation time period value	
Index	0x60C2	
Subindex	0x01	
Data type	UNSIGNED8	
Access type	RW	
Default value	0	
Value range	0	40
PDO mapping	RXPDO	
Persistent	YES	

6.2.115.2. Interpolation time index

This object defines the unit of the Interpolation time period value. The value −3 corresponds to the unit [ms].

Name	Interpolation time index
Index	0x60C2
Subindex	0x02
Data type	INTEGER8
Access type	RW
Default value	-3
Value range	-3 only
PDO mapping	RXPDO
Persistent	NO

6.2.116. Max acceleration

Used to limit the maximum allowed acceleration to prevent mechanical damage. It represents the limit of all other acceleration/deceleration objects on the axis.
Operation modes I/O Current Mode (IOCM), Cyclic Synchronous Torque Mode (CST) and Cyclic Synchronous Velocity Mode (CSV) are not limited by this value.
The value is given in [acceleration units].

Related objects: Profile acceleration, Profile deceleration, Quick stop deceleration

Name	Max acceleration	
Index	0x60C5	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RW	
Default value	4'294'967'295	
Value range	1	4'294'967'295
PDO mapping	RXPDO	
Persistent	YES	

6.2.117. Additional velocity actual values

This object provides the actual velocity values of the axis derived from the sensors defined in Axis configuration. If no sensor is configured in the corresponding field, the actual velocity value is "0" (zero).
The value is given in [velocity units].
The averaged velocity values represent the actual velocity filtered by a first-order digital low-pass filter with a cut-off frequency of 5 Hz.

Related objects: Velocity actual values, Velocity actual value

Name	Additional velocity actual values
Index	0x60E5
Object code	ARRAY
Highest subindex supported	10

6.2.117.1. Velocity actual value sensor 1

Name	Velocity actual value sensor 1	
Index	0x60E5	
Subindex	0x01	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.117.2. Velocity actual value sensor 2

Name	Velocity actual value sensor 2	
Index	0x60E5	
Subindex	0x02	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-

PDO mapping	TXPDO
Persistent	NO

6.2.117.3. Velocity actual value averaged sensor 1

Name	Velocity actual value averaged sensor 1	
Index	0x60E5	
Subindex	0x09	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.117.4. Velocity actual value averaged sensor 2

Name	Velocity actual value averaged sensor 2	
Index	0x60E5	
Subindex	0x0A	
Data type	INTEGER32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

6.2.118. Digital inputs

This object shows the state of the CiA digital input functionalities (after polarity correction by Digital input properties, Polarity). A bit is read as "1" if the signal at the corresponding pin is high. This value is a subset of Digital inputs functionality.

Related objects: Digital input properties / Configuration of digital inputs, Digital inputs functionality

Name	Digital inputs	
Index	0x60FD	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RO	
Default value	-	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Bit	Functionality	Description
31..24	Reserved	–
23	General purpose H	State can be read
22	General purpose G	State can be read
21	General purpose F	State can be read
20	General purpose E	State can be read
19	General purpose D	State can be read
18	General purpose C	State can be read
17	General purpose B	State can be read
16	General purpose A	State can be read
15..2	Reserved	-
1	Positive limit switch	Generates Positive limit switch error
0	Negative limit switch	Generates Negative limit switch error

Table 146. Digital Inputs

6.2.119. Digital outputs

This object configures the state of the digital output functionalities (before polarity correction by Digital outputs polarity). If a bit is set to "1" and the polarity bit is set to "0," the signal at the corresponding pin is high.
This value is a CiA-conforming subset of Digital outputs functionality.

Related objects: Digital outputs properties, Configuration of digital outputs, Digital outputs functionality.

Name	Digital outputs
Index	0x60FE
Object code	ARRAY
Highest subindex supported	1

6.2.119.1. Physical outputs

This object is read/write, however, bits 24→31 are ignored upon writing.

Name	Physical outputs
Index	0x60FE
Subindex	0x01
Data type	UNSIGNED32
Access type	RW
Default value	0x0
Value range	Digital outputs - values
PDO mapping	RXPDO
Persistent	NO

Bit	Functionality	Description
31..19	Reserved	-
18	General purpose C	State can be read/written by the host
17	General purpose B	State can be read/written by the host

Bit	Functionality	Description
16	General purpose A	State can be read/written by the host
15…0	Reserved	-

Table 147. Digital outputs - values

6.2.120. Target velocity

Indicates the configured target velocity and is used as input for the trajectory generator. The value is given in [velocity units]. Supported modes are I/O Velocity Mode (IOVM), Cyclic Synchronous Velocity Mode (CSV) and Profile Velocity Mode (PVM).

Related objects:

- Max profile velocity
- Max motor speed
- Profile acceleration
- Profile deceleration

Name	Target velocity	
Index	0x60FF	
Subindex	0x00	
Data type	INTEGER32	
Access type	RW	
Default value	0	
Value range	-	-
PDO mapping	RXPDO	
Persistent	NO	

6.2.121. Motor type

Defines the motor type. Changes are only supported in device state «Power Disable» Device control.
Related objects: Axis configuration, Motor data

Name	Motor type
Index	0x6402
Subindex	0x00
Data type	UNSIGNED16
Access type	RW
Default value	10
Value range	Motor type values
PDO mapping	NO
Persistent	YES

Value	DS-402 Name	Description
1	Phase-modulated DC motor	Brushed DC motor (maxon DC motor)
10	Sinusoidal PM BL motor	Brushless DC motor BLDC sinus commutated (maxon EC motor)

Table 148. Motor type values

6.2.122. Supported drive modes

Provides an overview of the implemented operating modes on the device. Supported are the following modes:

- Profile Velocity Mode (PVM)
- Cyclic Synchronous Velocity Mode (CSV)
- Cyclic Synchronous Torque Mode (CST)
- I/O Velocity Mode (IOVM)
- I/O Current Mode (IOCM)

Name	Supported drive modes	
Index	0x6502	
Subindex	0x00	
Data type	UNSIGNED32	
Access type	RO	
Default value	0x0006'0304	
Value range	-	-
PDO mapping	TXPDO	
Persistent	NO	

Bit		Description
31…19	0	Reserved
18	1	I/O Current Mode (IOCM)
17	1	I/O Velocity Mode (IOVM)
16…11	0	Reserved
10	0	Cyclic Synchronous Torque Mode With Commutation Angle (CSTCA)
9	1	Cyclic Synchronous Torque Mode (CST)
8	1	Cyclic Synchronous Velocity Mode (CSV)
7	0	Cyclic Synchronous Position Mode (CSP) [a]
6	0	Interpolated Position Mode (IPM) [a]
5	0	Homing Mode (HMM) [a]
4	0	Reserved
3	0	Torque Mode [a]
2	1	Profile Velocity Mode (PVM)
1	0	Velocity Mode [a]
0	0	Profile Position Mode (PPM) [a]
[a] This drive mode will not be supported for ESCON2		

Table 149. Supported drive modes - Bits

maxon

7. Error handling

7.1. Emergency message frame

Upon detection of device-internal errors, the device will transmit emergency message frames over the CANopen network. See ESCON2 Communication Guide [10], chapter “CAN communication”.

7.2. Device errors

The device can detect a variety of device errors. The reaction to an error depends on the error type and fault reaction code. After execution of the fault reaction, the device changes to a fault state and the drive will be disabled.

The Error history holds the error codes that occurred and will be signaled via an emergency message frame.

The Error register holds all set error flags and provides a summary of possible errors.

For fault reaction codes, the following notations will be used:

- a: Use Abort connection option code
- f: Use Fault reaction option code
- d: A secure movement is no longer possible; disable the drive function
- w: No effect on device status (warning)

Error code	Error register	Name	Fault reaction code
0x0000	0000 0000b	No Error	-
0x1000	0000 0001b	Generic error	d
0x1080	1000 0001b	Generic initialisation error	d
0x2310	0000 0011b	Overcurrent error	d
0x2320	0000 0011b	Power stage protection error	d
0x2380	0000 0011b	Power stage protection error	d
0x3210	0000 0101b	Overvoltage error	d
0x3220	0000 0101b	Undervoltage error	d
0x4382	0000 1001b	Thermal power stage overload error	d
0x4383	0000 1001b	Thermal power stage overload warning	w
0x4384	0000 1001b	Thermal logic section overload error	d
0x5480	1000 0001b	Hardware error	d
0x5481	1000 0001b	Hardware defect loading parameter error	d
0x5482	1000 0001b	Hardware configuration error	d
0x5483	1000 0001b	Hardware configuration error	d
0x5484	1000 0001b	Hardware configuration error	d
0x6180	1000 0001b	Internal software error	d
0x6181	1000 0001b	Internal software error	d
0x6380	1000 0001b	Loading parameter failed error	d
0x6381	1000 0001b	Loading parameter failed error	d
0x6382	1000 0001b	Loading parameter failed error	d
0x6388	1000 0001b	Torque constant parameter error	d

Error code	Error register	Name	Fault reaction code
0x7280	0000 0011b	Current offset adjustment warning	w
0x7380	1000 0001b	Main sensor breach error	d
0x7388	1000 0001b	Hall sensor signal error	d
0x738A	1000 0001b	Hall angle detection error	d
0x7390	1000 0001b	Missing main sensor error	d
0x7391	1000 0001b	Missing commutation sensor error	d
0x7392	1000 0001b	Main sensor direction error	d
0x8110	0001 0001b	CAN overrun error (object lost)	a
0x8120	0001 0001b	CAN passive mode error	a
0x8130	0001 0001b	CAN heartbeat error	a
0x81FC	0001 0001b	CAN Tx PDO overflow	a
0x81FD	0001 0001b	CAN bus off error	a
0x81FE	0001 0001b	CAN Rx overflow	a
0x81FF	0001 0001b	CAN Tx overflow	a
0x8210	0001 0001b	CAN PDO length error	a
0x8250	0010 0001b	CAN PDO timeout	f
0x8A80	1000 0001b	Negative limit switch error	f
0x8A81	1000 0001b	Positive limit switch error	f
0x8A89	1000 0001b	Digital input 1 PWM frequency warning	w
0x8A8A	1000 0001b	Digital input 1 PWM duty cycle warning	w
0x8A8C	1000 0001b	Digital input 1 PWM error	d
0x8A8D	1000 0001b	Digital input 2 PWM frequency warning	w
0x8A8E	1000 0001b	Digital input 2 PWM duty cycle warning	w
0x8A90	1000 0001b	Digital input 2 PWM error	d
0xFF01	1000 0001b	System overloaded warning	w
0xFF02	1000 0001b	Watchdog error	d
0xFF03	1000 0001b	Watchdog error	d
0xFF06	1000 0001b	System peak overloaded error	d
0xFF07	1000 0001b	System peak overloaded error	d
0xFF08	1000 0001b	Data recorder unreliability warning	w
0xFF0D	1000 0001b	Mode of operation not supported error	d
0xFF11	1000 0001b	Regulation tuning identification error	d
0xFF12	1000 0001b	Regulation tuning current error	d
0xFF13	1000 0001b	Regulation tuning identification current error	d
0xFF14	1000 0001b	Regulation tuning unrealistic result error	d
0xFF15	1000 0001b	Regulation tuning identification error	d
0xFF16	1000 0001b	Regulation tuning identification error	d
0xFF17	1000 0001b	Regulation tuning identification error	d
0xFF18	1000 0001b	Regulation tuning identification error	d
0xFF19	1000 0001b	Regulation tuning identification error	d

Error code	Error register	Name	Fault reaction code
0xFF20	1000 0001b	Regulation tuning standstill error	d
0xFF21	1000 0001b	Regulation tuning torque constant error	d
0xFF22	1000 0001b	Regulation tuning max system speed error	d
0xFF23	1000 0001b	Regulation tuning motor connection error	d
0xFF24	1000 0001b	Regulation tuning sensor signal error	d

Table 150. Device error codes

7.2.1. Generic error

Error code	0x1000
Error register	0000 0001b
Cause	Unspecific error occurred
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword

7.2.2. Generic initialisation error

Error code	0x1080
Error register	1000 0001b
Cause	Critical error occurred during boot-up.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset device. If the problem persists, contact your supplier.

7.2.3. Overcurrent error

Error code	0x2310
Error register	0000 0011b
Cause	Short circuit in motor winding. Controller gains too high and/or deceleration too high. Damaged power stage.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword

7.2.4. Power stage protection error

Error code	0x2320
Error register	0000 0011b
Cause	Short circuit of the motor winding against the ground. Short circuit of motor winding against operating voltage Vcc. Damaged power stage. Strong motor ripple (on top of a high peak current draw). High deceleration or acceleration demands (which push the control to its limits). Max. peak current configured, which is close to the power stage current protection level. Poor current control parameter set. Possible loose contact.

Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword

7.2.5. Power stage protection error

Error code	0x2380
Error register	0000 0011b
Cause	Short circuit of the motor winding against the ground. Short circuit of motor winding against operating voltage Vcc. Damaged power stage. Strong motor ripple (on top of a high peak current draw). High deceleration or acceleration demands (which push the control to its limits). Max. peak current configured, which is close to the power stage current protection level. Poor current control parameter set. Possible loose contact.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword

7.2.6. Overvoltage error

Error code	0x3210
Error register	0000 0101b
Cause	Power supply voltage too high.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	In most cases, this error occurs during deceleration, when the motor works as a generator and energy flows from the motor to the power supply, causing an increase in voltage. Usually, a capacitor (for example, 2200 µF) placed close to the device will solve the problem. If not, a shunt regulator will be necessary to dissipate the brake energy. Reset the fault with Controlword (this is only possible if the supply voltage is within a valid range).

7.2.7. Undervoltage error

Error code	0x3220
Error register	0000 0101b
Cause	Either: - Supply voltage is too low for operation. - Power supply cannot supply the required acceleration current.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword (this is only possible if the supply voltage is within a valid range or if the drive is not enabled).

7.2.8. Thermal power stage overload error

Error code	0x4382
Error register	0000 1001b
Cause	Temperature power stage reached critical level.

Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword when the temperature has fallen below the threshold.

7.2.9. Thermal power stage overload warning

Error code	0x4383
Error register	0000 1001b
Cause	Temperature power stage is high.
Effect	The maximum output current is actively reduced as the temperature rises. The red LED will blink "Slow." The warning bit is set in Statusword.
Error recovery	The warning automatically clears when the temperature falls below the warning threshold.

7.2.10. Thermal logic section overload error

Error code	0x4384
Error register	0000 1001b
Cause	Temperature logic section reached critical level.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword (this is only possible if the temperature is within a valid range).

7.2.11. Hardware error

Error code	0x5480
Error register	1000 0001b
Cause	A hardware problem was detected.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device. If the problem persists, contact your supplier.

7.2.12. Hardware defect loading parameter error

Error code	0x5481
Error register	1000 0001b
Cause	Loading (restoring) persistent parameter failed due to hardware error. The parameters may have an inconsistent state.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device. If the problem persists, contact your supplier.

7.2.13. Hardware configuration error

Error code	0x5482
Error register	1000 0001b
Cause	A hardware error occurred during configuration.

Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device. If the problem persists, contact your supplier.

7.2.14. Hardware configuration error

Error code	0x5483
Error register	1000 0001b
Cause	A hardware error occurred during configuration.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device. If the problem persists, contact your supplier.

7.2.15. Hardware configuration error

Error code	0x5484
Error register	1000 0001b
Cause	A hardware error occurred during configuration.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword. If the problem persists, contact your supplier.

7.2.16. Internal software error

Error code	0x6180
Error register	1000 0001b
Cause	Internal software error occurred.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device. If the problem persists, contact your supplier.

7.2.17. Internal software error

Error code	0x6181
Error register	1000 0001b
Cause	Internal software error occurred.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword. If the problem persists, contact your supplier.

7.2.18. Loading parameter failed error

Error code	0x6380
Error register	1000 0001b
Cause	Loading persistent parameter failed. The default values are restored.

Effect	Default parameters are set The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the fault with Controlword Set or load the device parameters again.

7.2.19. Loading parameter failed error

Error code	0x6381
Error register	1000 0001b
Cause	Loading persistent parameter failed. The default values are restored.
Effect	Default parameters are set The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device. If the problem persists, contact your supplier.

7.2.20. Loading parameter failed error

Error code	0x6382
Error register	1000 0001b
Cause	Loading persistent parameter failed. The default values are restored.
Effect	Default parameters are set The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Reset the device If the problem persists, contact your supplier.

7.2.21. Torque constant parameter error

Error code	0x6388
Error register	1000 0001b
Cause	The open loop velocity control structure can be used only, if the torque constant is parameterized/tuned.
Effect	The device is disabled The red LED is “ON” The error bit is set in Statusword
Error recovery	Configure the torque constant with the value from the datasheet. If a torque constant derived from tuning is desired, disable the open-loop velocity control structure and execute regulation tuning. Reset the fault with Controlword.

7.2.22. Current offset adjustment warning

Error code	0x7280
Error register	0000 0011b
Cause	During the current offset calibration an error occurred. This usually occurs if the motor is already turning upon enable.
Effect	The red LED blinks "Slow." The warning bit is set in Statusword.
Error recovery	The warning automatically clears after a successful current offset calibration. Alternatively, reset the warning with Controlword (this is possible in any device state). Ensure the motor is stationary when enabling.

7.2.23. Main sensor breach error

Error code	0x7380
Error register	1000 0001b
Cause	Sensor supervision has detected a bad working condition due to: - wrong/broken wiring of encoder - defective encoder - regulation parameters are not well tuned (see Current control parameter set)
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Ensure the main sensor is properly connected. Reset the fault with Controlword.

7.2.24. Hall sensor signal error

Error code	0x7388
Error register	1000 0001b
Cause	Either: incorrect wiring of Hall sensors, or incorrect wiring of Hall sensor supply voltage, or damaged Hall sensors, or big Hall sensor signal noise
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.25. Hall angle detection error

Error code	0x738A
Error register	1000 0001b
Cause	Angle difference measured between the encoder and Hall sensors is too high due to: - wrong wiring of Hall sensors - defective Hall sensors - wrong wiring of encoder - defective encoder - wrong setting of encoder resolution or pole pairs
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Check that the pole pair number setting is correct. Check the sensor connections. Reset the fault with Controlword

7.2.26. Missing main sensor error

Error code	0x7390
Error register	1000 0001b
Cause	No main sensor available.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Adapt settings in Axis configuration Reset the fault with Controlword

7.2.27. Missing commutation sensor error

Error code	0x7391
Error register	1000 0001b

Cause	No commutation sensor available.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Adapt settings in Axis configuration Reset hte fault with Controlword

7.2.28. Main sensor direction error

Error code	0x7392
Error register	1000 0001b
Cause	Sensor supervision has detected a turn-away of the motor in the opposite direction due to: - wrong setting of sensor polarity - wrong sensor wiring - wrong motor wiring
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.29. CAN overrun error (object lost)

Error code	0x8110
Error register	0001 0001b
Cause	One of the CAN rx buffers experienced an overflow caused by too high communication rate.
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Reset the fault with Controlword

7.2.30. CAN passive mode error

Error code	0x8120
Error register	0001 0001b
Cause	Device changed to CAN passive mode due to: - CAN bit rate of one CAN node in network wrong - CAN network not connected - hardware wiring of CAN bus not correct
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Send the NMT command to reset communication, then reset the fault with Controlword.

7.2.31. CAN heartbeat error

Error code	0x8130
Error register	0001 0001b
Cause	CANopen Heartbeat Consumer procedure has detected a timeout, see Consumer heartbeat time.
Effect	The fault reaction is defined in the Abort connection option code. The state transition is defined in Communication error.
Error recovery	Reset the fault with Controlword

7.2.32. CAN Tx PDO overflow

Error code	0x81FC

Error register	0001 0001b
Cause	One of the CAN transmit queues had an overrun caused by too high communication rate due to: - load on CAN bus too high - event-triggered PDOs defined with too small inhibit time - PDO communication configured too high (synchronous) for actual cycle time.
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Reset the fault with Controlword

7.2.33. CAN bus off error

Error code	0x81FD
Error register	0001 0001b
Cause	CAN controller has entered CAN bus off state.
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Send the NMT command to reset communication, then reset the fault with Controlword.

7.2.34. CAN Rx overflow

Error code	0x81FE
Error register	0001 0001b
Cause	One of the CAN receive buffers had an overrun caused by too high communication rate.
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Reset the fault with Controlword

7.2.35. CAN Tx overflow

Error code	0x81FF
Error register	0001 0001b
Cause	One of the CAN transmit queues had an overrun caused by too high communication rate due to: - load on CAN bus too high - CAN bus inactive but heartbeat producer enabled. - too small inhibit time for emergency frames.
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Reset the fault with Controlword

7.2.36. CAN PDO length error

Error code	0x8210
Error register	0001 0001b
Cause	Received PDO was not processed due to length error (received data length is too short)
Effect	The fault reaction is defined in the Abort connection option code.
Error recovery	Reset the fault with Controlword

7.2.37. CAN PDO timeout

Error code	0x8250
Error register	0010 0001b
Cause	Interpolation aborted in cyclic mode due to no PDO received after elapsed time greater than 3 times the Interpolation time period value. The error also occurs if the master aborts communication, e.g. due to timing violations of the synchronous PDO transfer.

Effect	The fault reaction is defined in the Fault reaction option code.
Error recovery	Reset fault with Controlword Check master PDO transfer rate, and bus communication load.

7.2.38. Negative limit switch error

Error code	0x8A80
Error register	1000 0001b
Cause	Negative limit switch was/is active or wrong configuration of limit switch function
Effect	The fault reaction is defined in the Fault reaction option code.
Error recovery	Reset the fault with Controlword. To prevent the error from reoccurring in velocity-based operating modes, drive in the opposite direction.

7.2.39. Positive limit switch error

Error code	0x8A81
Error register	1000 0001b
Cause	Positive limit switch was/is active or wrong configuration of limit switch function
Effect	The fault reaction is defined in the Fault reaction option code.
Error recovery	Reset the fault with Controlword. To prevent the error from reoccurring in velocity-based operating modes, drive in the opposite direction.

7.2.40. Digital input 1 PWM frequency warning

Error code	0x8A89
Error register	1000 0001b
Cause	PWM input 1 is configured in Configuration of digital inputs, the measured PWM frequency is outside the specified range.
Effect	The frequency of PWM input 1 in Digital input 1 PWM frequency is restricted to a range of 50 Hz to 10 kHz. The red LED will blink "Slow." The warning bit is set in Statusword.
Error recovery	If the detected frequency is between 50 Hz and 10 kHz, the warning is cleared.

7.2.41. Digital input 1 PWM duty cycle warning

Error code	0x8A8A
Error register	1000 0001b
Cause	PWM input 1 is configured in Configuration of digital inputs, the measured PWM duty cycle is outside the specified range.
Effect	The duty cycle of PWM input 1 in Digital input 1 PWM duty cycle is restricted to a range of 10% to 90%. The red LED will blink "Slow." The warning bit is set in Statusword.
Error recovery	If the detected duty cycle is between 10% and 90%, the warning is cleared.

7.2.42. Digital input 1 PWM error

Error code	0x8A8C
Error register	1000 0001b
Cause	PWM input 1 is configured in Configuration of digital inputs, the measured PWM signal is invalid. For details, see display values Digital input 1 PWM frequency and Digital input 1 PWM duty cycle.

Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Set the PWM input to a valid range. Reset the fault with Controlword.

7.2.43. Digital input 2 PWM frequency warning

Error code	0x8A8D
Error register	1000 0001b
Cause	PWM input 2 is configured in Configuration of digital inputs, the measured PWM frequency is outside the specified range.
Effect	The frequency of PWM input 2 in Digital input 2 PWM frequency is restricted to a range of 50 Hz to 10 kHz. The red LED will blink "Slow." The warning bit is set in Statusword.
Error recovery	If the detected frequency is between 50 Hz and 10 kHz, the warning is cleared.

7.2.44. Digital input 2 PWM duty cycle warning

Error code	0x8A8E
Error register	1000 0001b
Cause	PWM input 2 is configured in Configuration of digital inputs, the measured PWM duty cycle is outside the specified range.
Effect	The duty cycle of PWM input 2 in Digital input 2 PWM duty cycle is restricted to a range of 10% to 90%. The red LED will blink "Slow." The warning bit is set in Statusword.
Error recovery	If the detected duty cycle is between 10% and 90%, the warning is cleared.

7.2.45. Digital input 2 PWM error

Error code	0x8A90
Error register	1000 0001b
Cause	PWM input 2 is configured in Configuration of digital inputs, the measured PWM signal is invalid. For details, see display values Digital input 2 PWM frequency and Digital input 2 PWM duty cycle.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Set the PWM input to a valid range. Reset the fault with Controlword.

7.2.46. System overloaded warning

Error code	0xFF01
Error register	1000 0001b
Cause	The system load of the device has reached a critical value.
Effect	The red LED blinks "Slow" The warning bit is set in Statusword
Error recovery	Reset the warning with Controlword (this is possible in every device state).

7.2.47. Watchdog error

Error code	0xFF02
Error register	1000 0001b

Cause	Device reset by watchdog due to fatal system overload or system fault.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.48. Watchdog error

Error code	0xFF03
Error register	1000 0001b
Cause	Device reset by watchdog due to fatal system overload or system fault.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.49. System peak overloaded error

Error code	0xFF06
Error register	1000 0001b
Cause	The device has not enough free resources to provide proper regulation.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword If the data recorder is active, reduce the sampling rate or the number of signals.

7.2.50. System peak overloaded error

Error code	0xFF07
Error register	1000 0001b
Cause	The device has not enough free resources to provide proper regulation.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.51. Data recorder unreliability warning

Error code	0xFF08
Error register	1000 0001b
Cause	The device has not enough free resources to provide proper recording. The recorded data may be unreliable (sampling deferred). Please, reduce sampling rate or number of signals.
Effect	The red LED blinks "Slow." The warning bit is set in Statusword.
Error recovery	Reset the warning with Controlword (this is possible in every device state) or by restarting the data recorder.

7.2.52. Mode of operation not supported error

Error code	0xFF0D
Error register	1000 0001b

Cause	The requested mode of operation is not supported with the configured control structure.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Change either the mode of operation or the control structure. Reset the fault with Controlword.

7.2.53. Regulation tuning identification error

Error code	0xFF11
Error register	1000 0001b
Cause	An error occurred during regulation tuning identification.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.54. Regulation tuning current error

Error code	0xFF12
Error register	1000 0001b
Cause	Required current could not be reached during regulation tuning.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Increase Nominal current and/or Output current limit (ensure that the maximum values of the motor specification are not exceeded). Reset the fault with Controlword

7.2.55. Regulation tuning identification current error

Error code	0xFF13
Error register	1000 0001b
Cause	Identification current could not be reached during regulation tuning identification.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Increase Nominal current and/or Output current limit (ensure that the maximum values of the motor specification are not exceeded). Reset the fault with Controlword

7.2.56. Regulation tuning unrealistic result error

Error code	0xFF14
Error register	1000 0001b
Cause	The resulting resistance or inductance value is unrealistic.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Check the motor parameters in Motor data. Reset the fault with Controlword. Run the tuning again.

7.2.57. Regulation tuning identification error

Error code	0xFF15

Error register	1000 0001b
Cause	An error occurred during regulation tuning identification.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.58. Regulation tuning identification error

Error code	0xFF16
Error register	1000 0001b
Cause	An error occurred during regulation tuning identification.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Check the motor parameters in Motor data. Reset the fault with Controlword Run all tuning again.

7.2.59. Regulation tuning identification error

Error code	0xFF17
Error register	1000 0001b
Cause	The resulting resistance or inductance value is unrealistic.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword. Run the tuning again.

7.2.60. Regulation tuning identification error

Error code	0xFF18
Error register	1000 0001b
Cause	An error occurred during regulation tuning identification.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Check the motor parameters in Motor data. Reset the fault with Controlword. Run the tuning again.

7.2.61. Regulation tuning identification error

Error code	0xFF19
Error register	1000 0001b
Cause	An error occurred during regulation tuning identification.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword Run the tuning again.

7.2.62. Regulation tuning standstill error

Error code	0xFF20

Error register	1000 0001b
Cause	Regulation tuning identification motor not in standstill, please ensure that the motor is not moving when starting tuning process.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Make sure the motor is at a standstill when starting tuning. Reset the fault with Controlword. Run the tuning again.

7.2.63. Regulation tuning torque constant error

Error code	0xFF21
Error register	1000 0001b
Cause	Regulation tuning identification motor torque value invalid, please ensure that the motor movement is not being obstructed during tuning process.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Ensure the motor movement is not obstructed. Reset the fault with Controlword. Run the tuning again.

7.2.64. Regulation tuning max system speed error

Error code	0xFF22
Error register	1000 0001b
Cause	Max system speed exceeded during Regulation tuning identification, reduce step amplitude to reduce max speed
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Increase the maximum motor speed. Reset the fault with Controlword. Run the tuning again.

7.2.65. Regulation tuning motor connection error

Error code	0xFF23
Error register	1000 0001b
Cause	Identification current is very small. Check the motor connection.
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Reset the fault with Controlword

7.2.66. Regulation tuning sensor signal error

Error code	0xFF24
Error register	1000 0001b
Cause	Sensor signal was not found during tuning identification, check the sensor or motor connection
Effect	The device is disabled. The red LED is "ON." The error bit is set in Statusword.
Error recovery	Check the sensor connection. Reset the fault with Controlword Run the tuning again.

7.3. Communication errors (abort codes)

An abort object will be sent over the network instead of a response to a SDO request if the request has failed. The same abort code will be sent as part of the response to other transfer request (such as USB).

The following abort codes are defined by CANopen Communication Profile CiA 301. Codes above 0x0F00'0000 are maxon-specific.

Abort code	Name	cause
0x0000 0000	No abort	Communication successful
0x0503 0000	Toggle error	Toggle bit not alternated
0x0504 0000	SDO timeout	SDO protocol timed out
0x0504 0001	Command unknown	Command specifier unknown
0x0504 0004	CRC error	CRC check failed
0x0601 0000	Access error	Unsupported access to an object
0x0601 0001	Write only error	Read command to a write only object
0x0601 0002	Read only error	Write command to a read only object
0x0601 0003	Subindex cannot be written	Subindex cannot be written, subindex 0 must be “0” (zero) for write access
0x0602 0000	Object does not exist error	Last read or write command had wrong object index or subindex
0x0604 0041	PDO mapping error	Object is not mappable to the PDO
0x0604 0042	PDO length error	Number and length of objects to be mapped would exceed PDO length
0x0604 0043	General parameter error	General parameter incompatibility
0x0604 0047	General internal incompatibility error	General internal incompatibility in device
0x0606 0000	Hardware error	Access failed due to hardware error
0x0607 0010	Service parameter error	Data type does not match, length or service parameter do not match
0x0607 0012	Service parameter too high error	Data type does not match, length of service parameter too high
0x0607 0013	Service parameter too low error	Data type does not match, length of service parameter too low
0x0609 0011	Subindex error	Last read or write command had wrong object subindex
0x0609 0030	Value range error	Value range of parameter exceeded
0x0800 0000	General error	General error
0x0800 0020	Transfer or store error	Data cannot be transferred or stored
0x0800 0022	Wrong device state error	Data cannot be transferred or stored to application because of present device state
0x0F00 FFC1	Segmented transfer expected	Unsupported access to an object, segmented access is expected

Table 151. Abort codes

8. Firmware version history

8.1. Version overview

For details consult the related controller's Firmware Version Readme [12].
The hardware number is defined under Definition of hardware version.

Date [yyyy-mm]	Version		Application		Firmware Specification DocID	Description
	Software	Hardware	#	Version		
2024-12	0110h	1101h, 1102h, 1103h	1000h	0000h	rel12690	New features and changes
2024-03	0100h	1101h, 1102h, 1103h	1000h	0000h	rel12245	Initial release

Table 152. Version overview