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emDrive Firmware Specifications

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History

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1 INTRODUCTION

1.1 General Information

This documentation “Firmware description” provides the firmware details of the emDrive150 controller. It contains detailed description of architecture, device states, operation modes, error handling and object dictionary.

EmDrive family are advanced BLDC motor controllers for e-drive systems. Drives are designed to power brushless and induction motors, it supports standard three hall sensor with 60 and 120 degree configuration, absolute digital SSI encoder with RS422 interface, resolver, 5V analogue sin/cos, and encoder. Due to the vector current control, torque ripple and vibrations in motor, there is no audible noise. Integrated current, velocity and position current control functionality allows accurate sophisticated positioning applications.

emDrives are specially designed to be controlled over CANopen network as a slave node and additionally can be operated through any RS232 communication port and local control.

1.2 Operating Principles

The CiD DSP 402 CANopen *Device Profile for Drives and Motion Control* is used to provide drives in a CAN network with an understandable and consistent behavior. The profile is built on top of a CAN communication profile, called CANopen, which describes the basic communication mechanisms common to all devices in the CAN network.

The purpose of the drive units is to connect axle controllers or other motion control products to the CAN bus. They usually receive configuration information via service data objects for I/O configuration, limit parameter for scaling, or application-specific parameters. At run time, data can be obtained from the drive unit via CAN bus either by polling or in event-driven mode (with properly-mapped TPDOs).

The motion control products use process-data object mapping for real-time operation, which may be configured using service data objects (SDOs). This communication channel is used to interchange real-time data-like set-points or actual values such as position actual values.

The most important part of a device profile is the object dictionary description. The object dictionary is essentially a grouping of objects accessible via the network in an ordered pre-defined fashion. The DSP 402 standard objects of single-axis drives, like the Harmonica, are all in the index range of 0x6000 to 0x67ff.

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2 SYSTEM OVERVIEW

3.1 Device Architecture

CAN Communication interface of the emDrive BLDC controller follows the CiA CANopen specifications:

- Support of all CiA 301 services
- Compliant to CiA-301 V4.2
- LED CiA-303

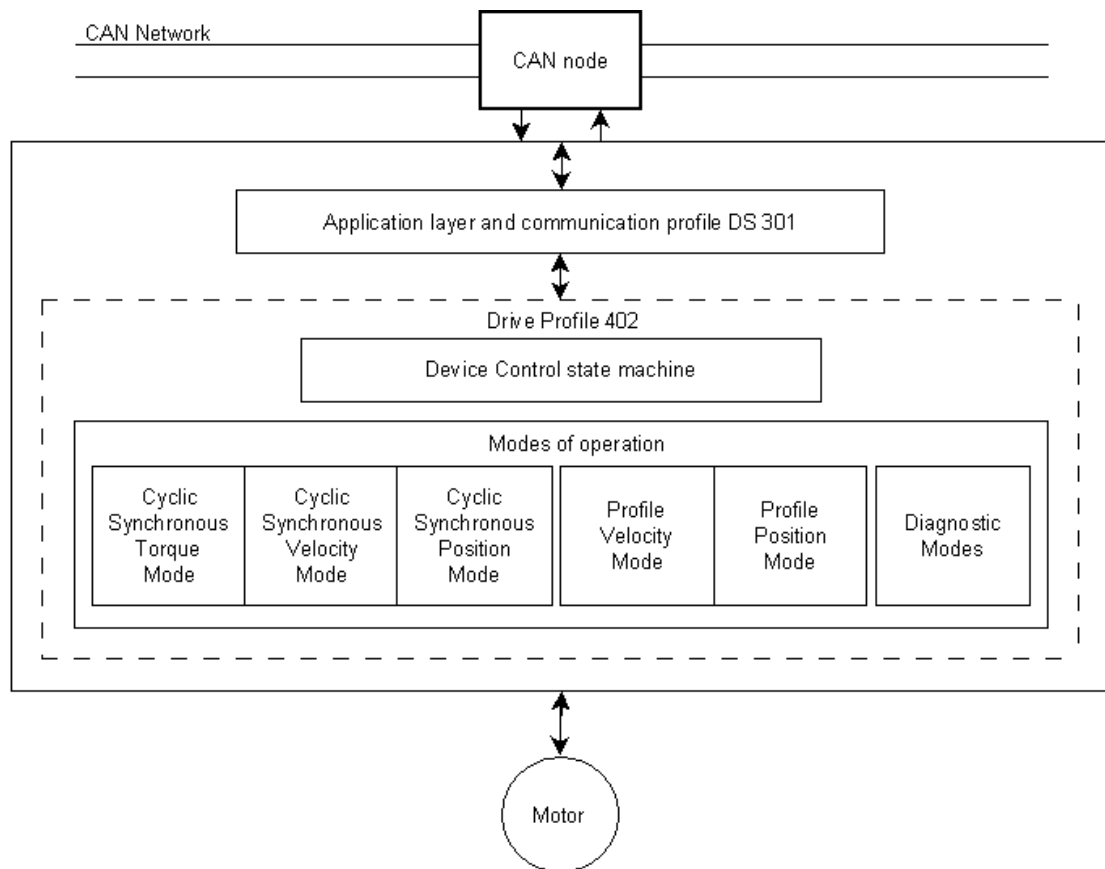


Figure 2-1: Communication architecture

Device Control

Drive managing and mode-specific command are executed by the state machine.

Modes of operation

Mode of operation is defining the behavior of the drive.

3.2 Device Control

Figure 2-2 contains detailed description of the device states and all possible controlling sequences for operating the emDrive.

Also states of the drives are determining which commands are accepted.

States may be changed using the *Controlword* and/or according to internal events. The current state can be read using the *Statusword*.

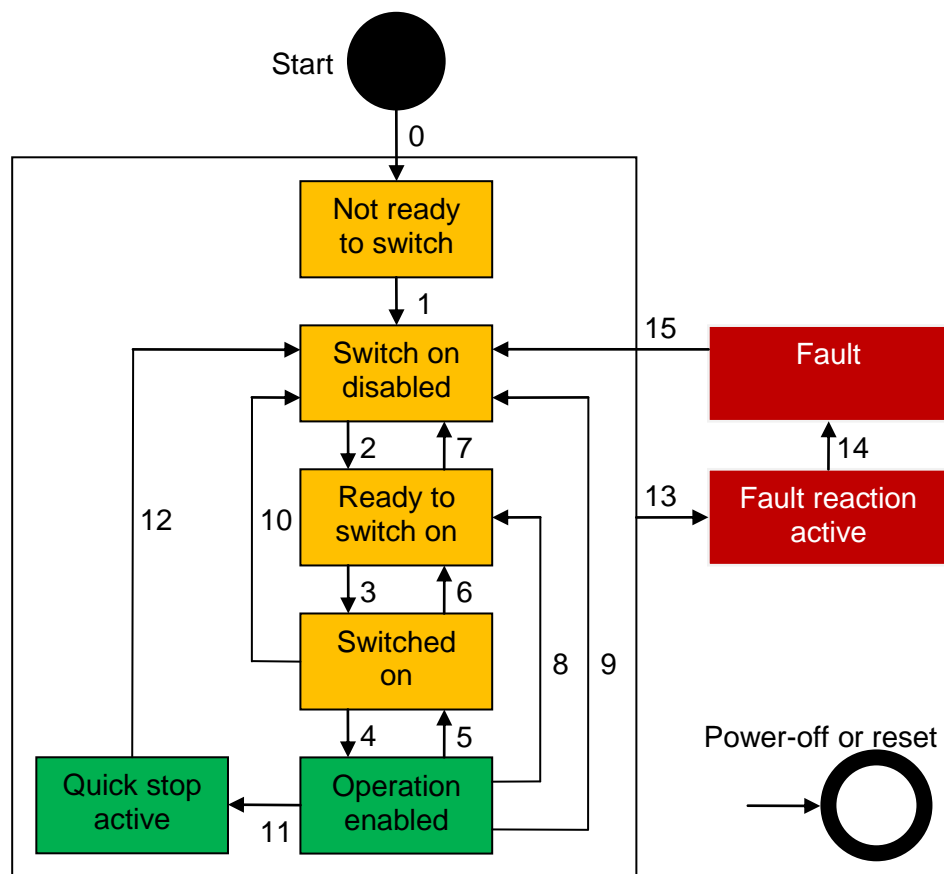


Figure 2-2: Device State Machine Block Diagram

3.2.1 State Transitions

State transitions are caused by internal events in the device or by command from host via the Controlword.

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

Table 2-1: Transition events and actions

Transition	Event(s)	Action(s)
0	Automatic transition after power-on or reset	Initialize drive, enable breaks, start local control if enabled
1	Automatic transition	Start safety procedure, disable drive function, initialize feedback, internal set-points cleared
2	“Shutdown” command from control device or local signal received	Disable drive function
3	“Switch on” command received from control device or local signal	Disable breaks
4	“Enable operation” command received from control device or local signal	Enable drive function
5	“Disable operation” command received from control device or local signal	Drive function disabled, disable breaks
6	“Shutdown” command received from control device or local signal	Drive functions disabled, enable breaks
7	“Quick stop” or “disable voltage” command received from control device or local signal	Drive functions disabled, enable breaks, initialize feedback, internal set-points cleared
8	“Shutdown” command received from control device or local signal	Drive functions disabled, enable breaks
9	“Disable voltage” command received from control device or local signal	Drive functions disabled, enable breaks, initialize feedback, internal set-points cleared
10	“Disable voltage” or “quick stop” command received from control device or local signal	Drive functions disabled, enable breaks, initialize feedback, internal set-points cleared
11	“Quick stop” command received from control device or local signal	none
12	Automatic transition	Disable drive function, initialize feedback, internal set-points cleared
13	Fault signal	None
14	Automatic transition	Disable drive function, enable break
15	“Fault reset” command received from control device or local signal	Clear fault condition if no fault is present

3.2.2 Device Control Commands

Device control commands are executed by writing in the *Controlword*, codes given in Table 2-2

Table 2-2: Command coding

Command	Bit of the <i>Controlword</i>					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3+4 (NOTE 1)
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4
Fault reset	From 0 to 1 (NOTE 2)	X	X	X	X	15

NOTE 1: Automatic transition to enable operation state after executing SWITCHED ON state functionality.

NOTE 2: Bit 7 transition from 0 to 1

4 ERROR CODES AND ERROR BEHAVIOR

4.1 Emergency Message Frame

When device-internal failure is detected emDrive will transmit emergency message frames over the CANopen with highest priority. Message frame shown in Table 4-1.

An emergency message frame will be transmitted only once per error event and consists of the *Error Code* and the actual *Error Register*.

Table 4-1: Emergency message frame

Byte	0	1	2	3	4	5	6	7
Content	Emergency error code		Error register	Not used (always "0")				

emDrive can detect several variety of device error. The reaction to an error depends on error type. After execution of the fault reaction, the device changes to fault state and the drive will be disabled.

4.2 Device Emergency Error Codes

4.2.1 0x1000 Generic error

Error Code	0x1000
Cause	Unspecific error occurred
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.2 0x2220 Overcurrent error

Error Code	0x2220
Cause	short circuit in motor winding controller gain to high (Current control parameters, Velocity control parameters) power stage damaged
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.3 0x3210 DC link over voltage

Error Code	0x3210
Cause	Power supply voltage to high
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.4 0xFF01 Phase A current measurement

Error Code	0xFF01
Cause	Current phase A hall sensor missing or damaged
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.5 0xFF02 Phase B current measurement

Error Code	0xFF02
Cause	Current phase A hall sensor missing or damaged
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.6 0xFF03 High side Fet short circuit

Error Code	0xFF03
Cause	DC voltage not applied to bridge or to low motor phases not connected to controller internal low side fet error circuit damaged damaged high side fets
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.7 0xFF04 Low side Fet short circuit

Error Code	0xFF04
Cause	DC voltage not applied to bridge or to low motor phases not connected to controller damaged low side fets
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.8 0xFF05 Low side Fet phase 1 short circuit

Error Code	0xFF05
Cause	motor phases not connected damaged low side fets on phase 1
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.9 0xFF06 Low side Fet phase 2 short circuit

Error Code	0xFF06
Cause	motor phases not connected damaged low side fets on phase 2

Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.10 0xFF07 Low side Fet phase 3 short circuit

Error Code	0xFF07
Cause	motor phases not connected damaged low side fets on phase 3
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.11 0xFF08 High side Fet phase 1 short circuit

Error Code	0xFF08
Cause	motor phases not connected damaged low side fets on phase 1
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.12 0xFF09 High side Fet phase 2 short circuit

Error Code	0xFF09
Cause	motor phases not connected damaged low side fets on phase 2
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.13 0xFF0A High side Fet phase 3 short circuit

Error Code	0xFF0A
Cause	motor phases not connected damaged low side fets on phase 3
Effect	device disabled red error led "on" error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.14 0xFF0B Motor Feedback

Error Code	0xFF0C
Cause	Wrong feedback selected (check feedback type) Feedback damaged or not connected
Effect	- device disabled - red error led "on" - error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.15 0xFF0C DC link undervoltage

Error Code	0xFF0C
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Cause	DC voltage not applied to bridge or to low
Effect	- device disabled - red error led "on" - error flag set in <i>Statusword</i> (bit 3)
Error Recovery	Reset fault with <i>Controlword</i>

4.2.16 0xFF0D Puls mode finished

Error Code	0xFF0D
Cause	Puls mode finished It's used for fine adjustments and troubleshooting
Effect	- device disabled - red error led "on"
Error Recovery	Reset fault with <i>Controlword</i>

4.2.17 0xFF0E Emergency button pressed

Error Code	0xFF0E
Cause	Emergency button pressed. If not used pin must be connected to GND
Effect	- device disabled - red error led "on"
Error Recovery	Reset fault with <i>Controlword</i>

5 MODES OF OPERATION

0x6060: Modes of operation

0x6061: Modes of operation display

5.1 Functional Description

The drive behavior depends on the activated modes of operation. Different modes can be implemented, although not in parallel. Therefore, the user must activate the required function by selecting modes of operation, through the object *Modes of Operation* and it's by default set to "no mode" (value – 0). Modes can be set in any state excluding *OPERATION ENABLED* in this state switching between modes of operation is not recommended. Actual modes of operation is displayed in *Modes of Operation Display*.

5.1.1 0x6060: Modes of operation

Object description:

Index	0x6060
Name	Modes of Operation
Data type	INTEGER8
Saved in EEPROM	Yes

Entry description:

Access	Read / write
PDO mapping	Allowed
Value range	INTEGER8
Default value	0

Data description:

Value	Description
-128...-6	Reserved
-5	Induction VF – testing purposes only
-4	Aligning rotor position
-3	Current stepper – testing purposes only
-2	Voltage stepper – testing purposes only
-1	Voltage constant angle – testing purposes only
0	No mode
1...7	Reserved
8	Cyclic sync position
9	Cyclic sync velocity
10	Cyclic sync torque
11...127	Reserved

- A read of this object shows only the new value of modes of operation. The actual mode of the drive is reflected in the *modes of operation display* (0x6061). It may be changed by writing to modes of operation.
- An attempt to access an unsupported mode causes the *modes operation* set to *no mode*.

5.1.2 0x6061 Modes of operation display

This object shows the current mode of operation. The meaning of the returned value corresponds to *modes of operation* option code (0x6060).

Object description:

Index	0x6061
Name	Modes of Operation display
Data type	INTEGER8
Saved in EEPROM	No

Entry description:

Access	Read only
PDO mapping	Not allowed
Value range	INTEGER8
Default value	0

Data description:

Similar to object 0x6060, *modes of operation*.

5.1.2.1 Induction VF

Induction VF mode uses *Test Mode Command* (0x2031) to command the Phase Voltage calculation function. For enabling *Induction VF* mode *Test Stepper Enable* (0x2040,10) must be set.

In this mode NO protections and limits are active. **Proposed use only for developers.**

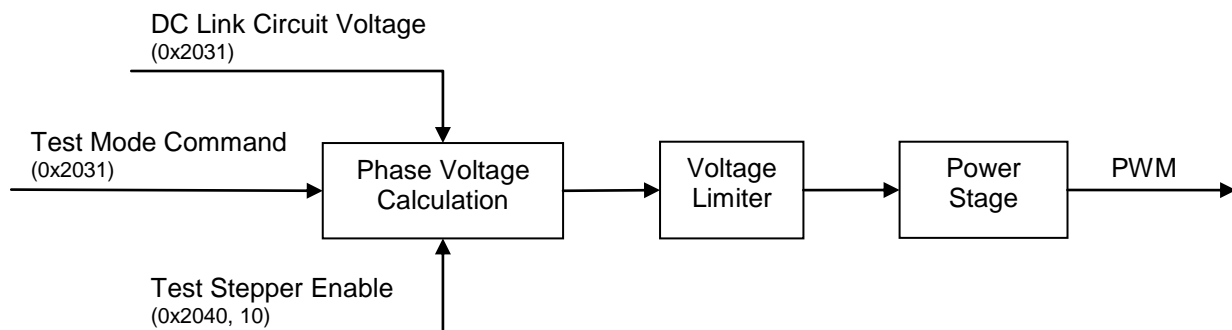


Figure 0-1 Induction VF – Block Diagram

5.1.2.2 Aligning Rotor Position

Aligning Rotor Position is used for determination of rotor position offset. Motor must be able to free spin.

Minimal requested settings for proper determination must be set:

- *Motor Type* (0x2034),
- *Motor Rated Current* (0x6075),
- *Motor Pole Pairs* (0x2033),
- *Feedback type* (0x2040, 1),
- *Feedback Resolution* (0x2040, 7),
- *Auto aligning rotor position current* (0x2040, 11).

Internal state machine is started as soon as proper *Modes of Operation* (0x6060) is selected and NMT state is changed to *operational*.

Motor will spin with 20 RPM in both directions for few seconds and calculate rotor position offset. If the procedure will be successful, *Motor Phase Offset* (0x2040, 3) and *Feedback Direction* (0x2040, 4) will be set, drive will go into *preoperation mode*. *Modes of Operation* (0x6060) will be set to 0 (*No Mode*).

In case that procedure will fail, drive will go into *Fail State*. In *Error Register* (0x1001) error code 0xFF0B (Error Motor Feedback) will be displayed.

5.1.2.3 Current Stepper

Current stepper mode uses *Test Mode Command* (0x2031) to command the current stepper control function. For enabling stepper, *Test Stepper Enable* (0x2040, 10) and *Test stepper Frequency* (0x2040, 5) must be set.

In this mode only maximum controller current limit is active, other protections and limits are inactive. **Proposed use only for developers.**

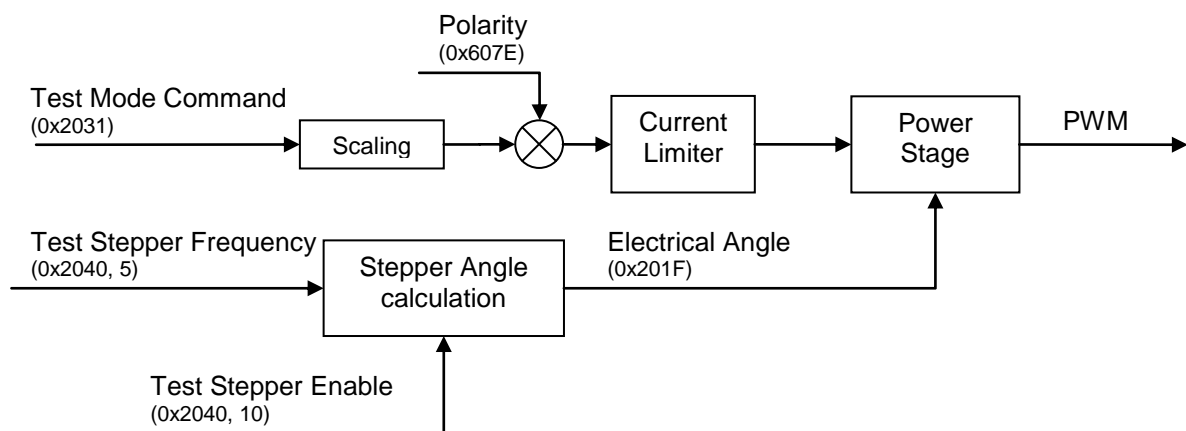


Figure 0-2 Current Stepper – Block Diagram

5.1.2.4 Voltage Stepper

Voltage stepper mode uses *Test Mode Command* (0x2031) to command the voltage stepper control function. For enabling stepper, *Test Stepper Enable* (0x2040, 10) and *Test stepper Frequency* (0x2040, 5) must be set.

In this mode NO protections and limits are active. **Proposed use only for developers.**

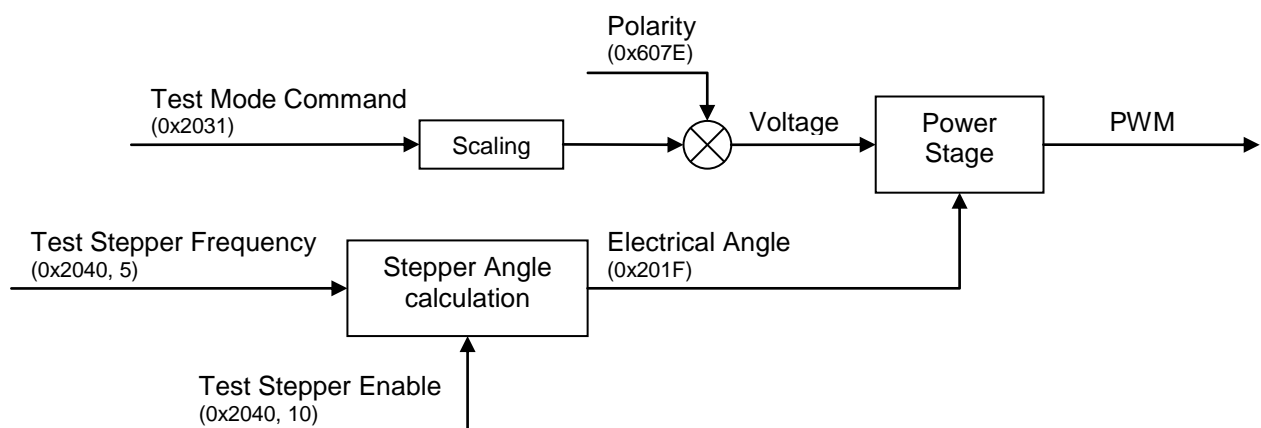


Figure 0-3 Voltage Stepper – Block Diagram

5.1.2.5 Cyclic Sync Torque

Cyclic Sync Torque mode uses *Target Torque* (0x6071) to command the current control function. Find description for block “*Limiter*” in paragraph 5.1.3 Output current Limitation. Optionally local control can be enabled and an analog input can be used to command the current control function.

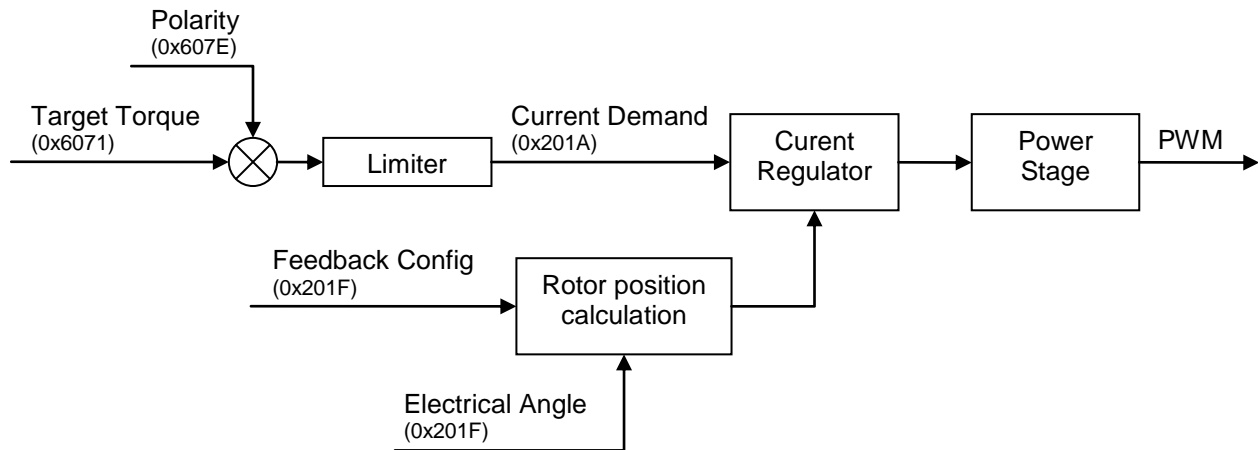


Figure 0-4 Cyclic Sync Torque – Block Diagram

5.1.2.6 Cyclic Sync Velocity

Cyclic Sync Velocity mode uses *Target Velocity* (0x60FF) to command the velocity control function. Find description for block “*Limiter*” in paragraph 5.1.3 Output current Limitation. Optionally local control can be enabled and an analog input can be used to command the velocity control function.

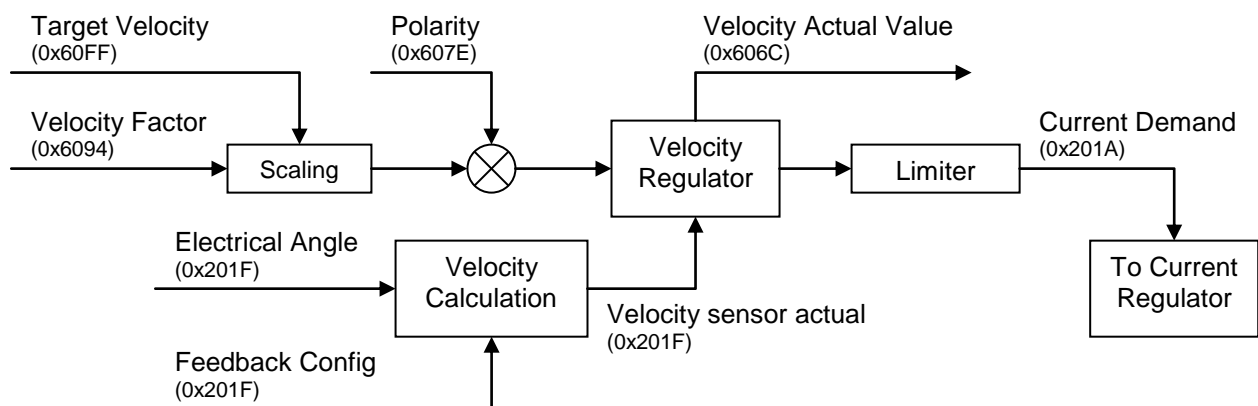


Figure 0-5 Cyclic Sync Velocity – Block Diagram

5.1.2.7 Cyclic Sync Position

Cyclic Sync Position mode uses *Target Position* (0x607A) to command the position control function. Find description for block “*Limiter*” in paragraph 5.1.3 Output current Limitation. Optionally local control can be enabled and an analog input can be used to command the position control function.

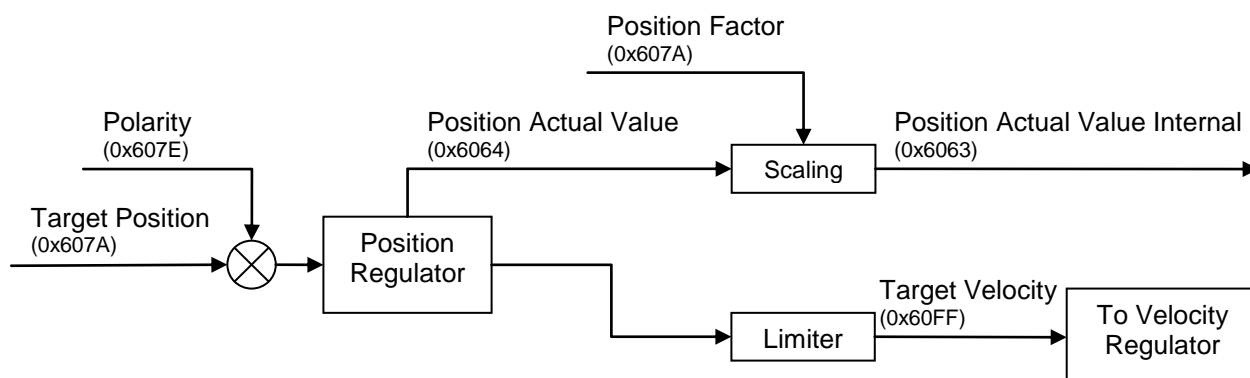


Figure 0-6 Cyclic Sync Position – Block Diagram

5.1.3 Output current Limitation

Output current limitation function is limiting *Current Demand* (0x201a) according limit values which can be set in objects:

- *Motor Maximum Temperature* (0x2058),
- *Motor Maximum Temperature Gain* (0x2059),
- *Maximum Velocity* (0x2052, 1),
- *Maximum Velocity Gain* (0x2052, 2),
- *Undervoltage Limit* (0x2055, 1),
- *Undervoltage Limit Gain* (0x2055, 2),
- *Overvoltage Limit* (0x2054),
- *Stall Protection Current* (0x205c),
- *Stall Protection Time* (0x205b).

Controller temperature is also monitored and it's linearly for each degree of over temperature (85°C) limiting maximum current for 20% of maximum controller current.

If any of current limits are active, Warning Yellow LED will be turned on, also bit will be set in *Warning* (0x2027) according active limits.

Object description:

Index	0x2027
Name	Warning
Data type	UNSIGNED16
Saved in EEPROM	No

Entry description:

Access	Read
PDO mapping	Allowed
Default value	0

Data description:

Bit pattern (MSB...LSB)	Description
0000 0000 0000 0001	Controller Temperature
0000 0000 0000 0010	Motor Temperature
0000 0000 0000 0100	DC Link Under Voltage
0000 0000 0000 1000	DC Link Over Voltage
0000 0000 0001 0000	Stall
0000 0000 0010 0000	Maximum Velocity

6 FEEDBACK CONFIG

0x2040: Feedback Config

In object Feedback Config (0x2040) user is able to set all settings according position feedback:

- Feedback Type
- Position Observer Enable
- Motor Phase Offset
- Feedback Direction
- Test Stepper Frequency
- Speed Filtering
- Motor Phase Offset Compensation
- Test Stepper Enable
- Auto Align Rotor Position Current

All feedback setting must be done in NMT state Preoperational. Parameters must be saved and the emDrive must be restarted.

6.1 0x2040, 1 Feedback Type

emDrive is supporting several different feedback types which are selectable through object Feedback Type (0x2040, 1).

Selection must be done in NMT state Preoperational.

Object description:

Index	0x2040
Name	Feedback Type
Data type	UNSIGNED8
Saved in EEPROM	Yes

Entry description:

Access	Read / Write
PDO mapping	Allowed
Default value	3

Data description:

Register data	Feedback type
0	Constant Angle
1	Hall Six Step Commutation
2	SSI
3	Resolver
4	Sin / Cos
5	Encoder
6	Hall Predictive
7 ... 255	Reserved

Hint:

If using Motor with hall feedback (selected feedback Type Hall six step commutation or Hall predictive) Feedback resolution must be set to 6.

7 INPUTS AND OUTPUTS

7.1 Analog Inputs

The drive supports three analog inputs with resolution of 12bit (5V). One is used for motor temperature measurements, other two may be used for general purpose process values like reference for desired speed, torque or position etc.

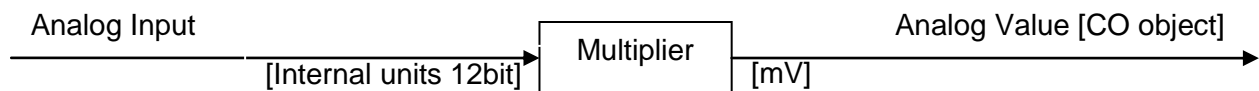


Figure 7 Analog Inputs Block Diagram

7.1.1 Output data description

The output values are given in the object Analog Values. For each analog input voltage on AD pin can be read in corresponding Analog value.

7.2 Digital Inputs

The drive supports 3-6 digital inputs (depends of emDrive type). They may be used for general purpose process like enable FW, RW, Brake etc.

7.2.1 Output data description

The output values are given in the object Digital Values. Corresponding flag is set in object. Polarity of digital input is here already incorporated.

emDrive 400:

Din num.	Reserved										Din6	Din5	Din4	Din3	Din2	Din1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

emDrive150, emDrive H300:

Din num.	Reserved													Din3	Din2	Din1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Example:

If Din3 is active bit 13 will be set to 1 and value in register will be 0x0002.

8 OBJECT DICTIONARY

8.1 0x1000 Device Type

Name	Device Type	
Index	0x1000	
Subindex	0x00	
Type	UNSIGNED32	
Access	RO	
Stored in EEPROM	Yes	
Default Value	0x0192	
Value range	0	4294967295
Map to PDO	No	

Description

This constant describes the device type. The value 0x0192 (400) mean that device follows the CiA Draft Standard Proposal 402, Device Profile Driver and Motion Control.

8.2 0x1001 Error register

Name	Error register	
Index	0x1001	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	No	
Default Value	0x00	
Value range	0	255
Map to PDO	Yes	

Description

This object is an error register for the device. The device maps internal errors in this byte.

Related Objects

Table 2 Error register bits

Bit	Description
0	Generic Error
1	Current
2	Voltage
3	Temperature
4	Communication Error
5	Device Profile Defined Error
6	Reserved (always zero)
7	Manufacturer specific

8.3 0x1005 COB ID SYNC

Name	COB ID SYNC	
Index	<i>0x1005</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>No</i>	
Default Value	<i>0x80</i>	
Value range	<i>0</i>	<i>4294967295</i>
Map to PDO	<i>No</i>	

Description

Communication Object Identifier of synchronization object.

8.4 0x1008 Manufacturer Device Name

Name	Manufacturer Device Name	
Index	<i>0x1008</i>	
Subindex	<i>0x00</i>	
Type	<i>VISIBLE_STRING</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>EMSISO</i>	
Value range	<i>0</i>	<i>0</i>
Map to PDO	<i>No</i>	

Description

The product name is “EMSISO”

8.5 0x100b Node-ID

Name	Node-ID	
Index	<i>0x100b</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0x01</i>	
Value range	<i>1</i>	<i>255</i>
Map to PDO	<i>No</i>	

8.6 0x1010 Store Parameter Field

Name	Store Parameter Field
Index	<i>0x1010</i>
Number of entries	<i>0x04</i>

Name	Save all Parameters
Index	<i>0x1010</i>
Subindex	<i>0x01</i>
Type	<i>VISIBLE_STRING</i>
Access	<i>RW</i>
Stored in EEPROM	<i>No</i>
Default Value	<i>0</i>
Value range	- -
Map to PDO	<i>No</i>

Description

All parameters of device where stored in non volatile memory, if the code “save” is written to this object.

Byte	MSB			LSB
Character	'e'	'v'	'a'	's'
Hexvalue	0x65	0x76	0x61	0x73

Controller must be restarted after this action is performed.

8.7 0x1011 Restore Default Parameters

Name	Restore Default Parameters
Index	<i>0x1011</i>
Number of entries	<i>0x04</i>

Name	Restore Default Parameters
Index	<i>0x1011</i>
Subindex	<i>0x01</i>
Type	<i>VISIBLE_STRING</i>
Access	<i>RW</i>
Stored in EEPROM	<i>No</i>
Default Value	<i>0</i>
Value range	- -
Map to PDO	<i>No</i>

Description

All parameters of device where restored with default values, if code “load” is written to this object.

Byte	MSB			LSB
Character	'd'	'a'	'o'	'l'
Hexvalue	0x64	0x61	0x6F	0x6C

Controller must be restarted after this action is performed.

8.8 0x1014 COB ID EMCY

Name	COB ID EMCY	
Index	0x1014	
Subindex	0x00	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	No	
Default Value	0x80 + node ID	
Value range	-	-
Map to PDO	No	

Description

Communication Object Identifier of emergency object.

8.9 0x1017 Producer Heartbeat Time

Name	Producer Heartbeat Time	
Index	0x1017	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	0	65535
Map to PDO	No	

Description

This producer heartbeat time defines the cycle time of heartbeat. The producer heartbeat time is 0 if not used. The time has to be a multiple of 1ms.

Remarks

It's not allowed for one device to use both error control mechanisms Guarding Protocol and Heartbeat Protocol at the same time. If the heartbeat producer time is equal to 0 the heartbeat protocol is used and the guarding protocol is disabled.

8.10 0x1018 Identity Object

Name	Identity Object	
Index	0x1018	
Number of entries	0x04	

Name	Vendor Id	
Index	0x1018	
Subindex	0x01	
Type	UNSIGNED32	
Access	RO	
Stored in EEPROM	-	

Default Value	000003C6	
Value range	0	4294967295
Map to PDO	No	

Description

The CANopen vendor identification of “Emsiso emDrives”

Name	Product Code	
Index	0x1018	
Subindex	0x02	
Type	UNSIGNED32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-	-
Map to PDO	No	

Name	Revision number	
Index	0x1018	
Subindex	0x03	
Type	UNSIGNED32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	4294967295
Map to PDO	No	

Description

CAN revision	Drive Major revision	Drive Minor revision
XX	XX	XX

8.11 0x1021 Store EDS

Name	Store EDS	
Index	0x1021	
Subindex	0x00	
Type	DOMAIN	
Access	RW	
Stored in EEPROM	-	
Default Value	Not defined	
Value range	-	-
Map to PDO	No	

Description

The Store EDS includes Electronic Datasheet which is used for the node.

Remarks

The electronic datasheet is read and written according to the format specified in entry 0x1022.

8.12 0x1022 Storage Format

Name	Store EDS	
Index	0x1022	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	-	
Default Value	Not defined	
Value range	-	-
Map to PDO	No	

Description

From FW version newer than 1.1.7 this entry defines the format that electronic datasheet is read from and written to entry 0x1021

Value	Description
0x0000	Uncompressed ASCII
0x0001	.zip

0x1029 Error behavior

Name	Error behavior	
Index	0x1029	
Number of entries	0x01	

Name	Communication Error	
Index	0x1029	
Subindex	0x01	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	0	1
Map to PDO	No	

Description

Value	Description
0x0000	Switches to Pre-operational
0x0001	Does not change states

8.13 0x1200 Server SDO parameter

Name	Server SDO parameter	
Index	0x1200	

Number of entries	<i>0x02</i>	
--------------------------	-------------	--

Name	COB ID Client to Server (Receive SDO)	
Index	<i>0x1200</i>	
Subindex	<i>0x01</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>Node ID + 0x600</i>	
Value range	<i>-</i>	<i>-</i>
Map to PDO	<i>No</i>	

Description

The communication Object Identifier of service data objects from master to device is shown here.

Name	COB ID Server to Client (Transmit SDO)	
Index	<i>0x1200</i>	
Subindex	<i>0x02</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>Node ID + 0x580</i>	
Value range	<i>-</i>	<i>-</i>
Map to PDO	<i>No</i>	

Description

The communication Object Identifier of service data objects from device to master is shown here.

8.14 0x1400 Receive PDO 1 Parameter

Name	Receive PDO 1 Parameter	
Index	<i>0x1400</i>	
Number of entries	<i>0x05</i>	

Name	COB ID receive PDO 1	
Index	<i>0x1400</i>	
Subindex	<i>0x01</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>Node ID + 0x200</i>	
Value range	<i>0</i>	<i>4294967295</i>
Map to PDO	<i>No</i>	

Description

Communication Object Identifier of receive process data object 1.

Name	Transmission type receive PDO 1	
Index	0x1400	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	0xFE	
Value range	0	255
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	synchron
255	asynchron

8.15 0x1401 Receive PDO 2 parameter

Name	Receive PDO 2 Parameter	
Index	0x1401	
Number of entries	0x02	

Name	COB ID receive PDO 2	
Index	0x1401	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	Node Id + 0x300	
Value range	0	4294967295
Map to PDO	No	

Description

Communication Object Identifier of receive process data object 2.

Name	Transmission type receive PDO 2	
Index	0x1401	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	0xFE	
Value range	0	255
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
-------	-------------

1	synchron
255	asynchron

8.16 0x1402 Receive PDO 3 parameter

Name	Receive PDO 3 Parameter	
Index	0x1402	
Number of entries	0x02	
Name	COB ID receive PDO 3	
Index	0x1402	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	Node Id + 0x300	
Value range	0	4294967295
Map to PDO	No	

Description

Communication Object Identifier of receive process data object 3.

Name	Transmission type receive PDO 3	
Index	0x1402	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	0xFE	
Value range	0	255
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	synchron
255	asynchron

8.17 0x1403 Receive PDO 4 parameter

Name	Receive PDO 4 Parameter	
Index	0x1403	
Number of entries	0x02	
Name	COB ID receive PDO 4	
Index	0x1403	
Subindex	0x01	
Type	UNSIGNED32	

Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>Node Id + 0x300</i>	
Value range	<i>0</i>	<i>4294967295</i>
Map to PDO	<i>No</i>	

Description

Communication Object Identifier of receive process data object 2.

Name	Transmission type receive PDO 4	
Index	<i>0x1403</i>	
Subindex	<i>0x02</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>0xFE</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	Synchron
255	Asynchrony

8.18 0x1600 Receive PDO 1 Mapping

Name	Receive PDO 1 Parameter	
Index	<i>0x1600</i>	
Number of entries	<i>0x08</i>	

Name	Number of mapped Application Objects in receive PDO	
Index	<i>0x1600</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>3</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Description

Changes in mapping are only possible in NMT state pre-operational. Before it's possible to enable PDO, it's necessary to map objects.

Value	Description
0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1600	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1600	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1600	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1600	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1600	
Subindex	0x05	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	7th mapped object	
-------------	-------------------------------------	--

Index	0x1600	
Subindex	0x07	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	8th mapped object	
Index	0x1600	
Subindex	0x08	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.19 0x1601 Receive PDO 2 mapping

Name	Receive PDO 2 Parameter	
Index	0x1601	
Number of entries	0x08	

Name	Number of mapped Application Objects in receive PDO	
Index	0x1601	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	1	
Value range	0	255
Map to PDO	No	

Description

Changes in mapping are only possible in NMT state pre-operational. Before it's possible to enable PDO, it's necessary to map objects.

Value	Description
0	PDO is disabled

1-8 One to eight objects are mapped

Name	1st mapped object	
Index	0x1601	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1601	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1601	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1601	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1601	
Subindex	0x05	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-

Map to PDO	<i>No</i>	
Name	7th mapped object	
Index	<i>0x1601</i>	
Subindex	<i>0x07</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>0</i>	
Value range	<i>-</i>	<i>-</i>
Map to PDO	<i>No</i>	
Name	8th mapped object	
Index	<i>0x1601</i>	
Subindex	<i>0x08</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>0</i>	
Value range	<i>-</i>	<i>-</i>
Map to PDO	<i>No</i>	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.20 0x1602 Receive PDO 3 Mapping

Name	Receive PDO 3 Parameter	
Index	<i>0x1602</i>	
Number of entries	<i>0x08</i>	
Name	Number of mapped Application Objects in receive PDO	
Index	<i>0x1602</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>3</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Description

Changes in mapping are only possible in NMT state pre-operational. Before it's possible to enable PDO, it's necessary to map objects.

Value	Description
0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1602	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1602	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1602	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1602	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1602	
Subindex	0x05	
Type	UNSIGNED32	
Access	RW	

Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	7th mapped object	
Index	0x1602	
Subindex	0x07	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	8th mapped object	
Index	0x1602	
Subindex	0x08	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.21 0x1603 Receive PDO 4 Mapping

Name	Receive PDO 4 Parameter	
Index	0x1603	
Number of entries	0x08	

Name	Number of mapped Application Objects in receive PDO	
Index	0x1603	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	3	
Value range	0	255
Map to PDO	No	

Description

Changes in mapping are only possible in NMT state pre-operational. Before it's possible to enable PDO, it's necessary to map objects.

Value	Description
0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1603	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1600	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1603	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1603	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1603	
Subindex	0x05	
Type	UNSIGNED32	

Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	<i>No</i>	

Name	7th mapped object	
Index	<i>0x1603</i>	
Subindex	<i>0x07</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	<i>No</i>	

Name	8th mapped object	
Index	<i>0x1603</i>	
Subindex	<i>0x08</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	<i>No</i>	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.22 0x1800 Transimt PDO 1 parameter

Name	Transmit PDO 1 Parameter	
Index	<i>0x1800</i>	
Number of entries	<i>0x06</i>	

Name	COB ID	
Index	<i>0x1800</i>	
Subindex	<i>0x01</i>	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	<i>Node ID + 0x180</i>	
Value range	-	-

Map to PDO

No

Description

Communication Object Identifier of transmit process data object 1.

Name	Transmission type transmit PDO 1	
Index	0x1800	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	0xFE	
Value range	0	255
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	Synchron
253	Asynchron on RTR only
255	Asynchron on change

Remarks

The transmission type 253 means that the PDO is only transmitted on remote transmission request (RTR). If transmission type 255 is selected the PDO is transmitted if the data's change its values. The inhibit time defines a minimum interval therefore.

Name	Inhibit time transmit PDO 1	
Index	0x1800	
Subindex	0x03	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	-	
Default Value	65535	
Value range	-	-
Map to PDO	No	

Description

The time is the minimum interval for event triggered PDO transmisson. The value is defined as multiple of 100µs.

Remarks

Event triggered PDOs can generate a huge CAN bus load also devise load especially if the inhibit time of different PDOs are set to a small value.

8.23 0x1801 Transmit PDO 2 parameter

Name	Transmit PDO 2 parameter	
Index	0x1801	
Number of entries	0x03	

Name	COB ID transmit PDO 2	
Index	0x1801	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	Node ID + 0x0280	
Value range	0x00000181	0x0000057F
Map to PDO	No	

Description

Communication Object Identifier of transmit data object 2.

Name	Transmission type transmit PDO 2	
Index	0x1801	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	253	
Value range	-	-
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	Synchron
253	Asynchron on RTR only
255	Asynchron on change

Remarks

The transmission type 253 means that the PDO is only transmitted on remote transmission request (RTR). If transmission type 255 is selected the PDO is transmitted if the data's change its values. The inhibit time defines a minimum interval therefore.

Name	Inhibit time transmit PDO 2	
Index	0x1801	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	253	
Value range	-	-
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	Synchron

253	Asynchron on RTR only
255	Asynchron on change

Remarks

The transmission type 253 means that the PDO is only transmitted on remote transmission request (RTR). If transmission type 255 is selected the PDO is transmitted if the data's change its values. The inhibit time defines a minimum interval therefore.

8.24 0x1802 Transmit PDO 3 parameter

Name	Transmit PDO 3 parameter	
Index	0x1802	
Number of entries	0x03	
Name	COB ID transmit PDO 3	
Index	0x1802	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	Node ID + 0x0380	
Value range	0x00000181	0x0000057F
Map to PDO	No	

Description

Communication Object Identifier of transmit process data object 3.

Name	Transmission type transmit PDO 3	
Index	0x1802	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	253	
Value range	-	-
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
1	Synchron
253	Asynchron on RTR only
255	Asynchron on change

Remarks

The transmission type 253 means that the PDO is only transmitted on remote transmission request (RTR). If transmission type 255 is selected the PDO is transmitted if the data's change its values. The inhibit time defines a minimum interval therefore.

Name	Inhibit time transmit PDO 3
-------------	------------------------------------

Index	0x1802	
Subindex	0x03	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	-	
Default Value	65535	
Value range	-	-
Map to PDO	No	

Description

This time is the minimum interval for event triggered PDO transmission. The value is defined as multiple of 100µs.

Remarks

Event triggered PDOs can generate a huge CAN bus load and also device load especially if the inhibit time of different PDOs are set to a small value.

8.25 0x1803 Transmit PDO 4 parameter

Name	Transmit PDO 4 parameter	
Index	0x1803	
Number of entries	0x03	

Name	COB ID transmit PDO 4	
Index	0x1803	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	Node ID + 0x0480	
Value range	0x00000181	0x0000057F
Map to PDO	No	

Description

Communication Object Identifier of transmit process data object 3.

Name	Transmission type transmit PDO 3	
Index	0x1803	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	253	
Value range	-	-
Map to PDO	No	

Description

The transmission type describes how PDO communication works. The following types are supported:

Value	Description
-------	-------------

1	Synchron
253	Asynchron on RTR only
255	Asynchron on change

Remarks

The transmission type 253 means that the PDO is only transmitted on remote transmission request (RTR). If transmission type 255 is selected the PDO is transmitted if the data's change its values. The inhibit time defines a minimum interval therefore.

Name	Inhibit time transmit PDO 4	
Index	0x1803	
Subindex	0x03	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	-	
Default Value	65535	
Value range	-	-
Map to PDO	No	

Description

This time is the minimum interval for event triggered PDO transmission. The value is defined as multiple of 100µs.

Remarks

Event triggered PDOs can generate a huge CAN bus load and also device load especially if the inhibit time of different PDOs are set to a small value.

8.26 0x1A00 Transmit PDO 1 mapping

Name	Transmit PDO 1 mapping	
Index	0x1A00	
Number of entries	-	

Name	Number of mapped Application Objects in transmit PDO	
Index	0x1A00	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	1	
Value range	0	8
Map to PDO	No	

Remarks

Changes in mapping are only possible in NMT state pre-operational. Before it is possible to enable PDO, it is necessary to map objects.

Value	Description
0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1A00	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1A00	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1A00	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1A00	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1A00	
Subindex	0x05	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	7th mapped object	
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Index	0x1A00	
Subindex	0x07	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	8th mapped object	
Index	0x1A00	
Subindex	0x08	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.27 0x1A01Transmit PDO 2 mapping

Name	Transmit PDO 2 mapping	
Index	0x1A01	
Number of entries	-	

Name	Number of mapped Application Objects in transmit PDO	
Index	0x1A01	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	1	
Value range	0	8
Map to PDO	No	

Remarks

Changes in mapping are only possible in NMT state pre-operational. Before it is possible to enable PDO, it is necessary to map objects.

Value	Description
0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1A01	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1A01	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1A01	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1A01	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1A01	
Subindex	0x05	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	7th mapped object	
Index	0x1A01	
Subindex	0x07	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	8th mapped object	
Index	0x1A01	
Subindex	0x08	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.28 0x1A02 Transmit PDO 3 mapping

Name	Transmit PDO 3 mapping	
Index	0x1A02	
Number of entries	-	

Name	Number of mapped Application Objects in transmit PDO	
Index	0x1A02	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	1	
Value range	0	8
Map to PDO	No	

Remarks

Changes in mapping are only possible in NMT state pre-operational. Before it is possible to enable PDO, it is necessary to map objects.

Value	Description
-------	-------------

0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1A02	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1A02	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1A02	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1A02	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1A02	
Subindex	0x05	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	

Value range	-	-
Map to PDO	No	

Name	7th mapped object	
Index	0x1A02	
Subindex	0x07	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	8th mapped object	
Index	0x1A02	
Subindex	0x08	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.29 0x1A03 Transmit PDO 4 mapping

Name	Transmit PDO 3 mapping	
Index	0x1A03	
Number of entries	-	

Name	Number of mapped Application Objects in transmit PDO	
Index	0x1A03	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	1	
Value range	0	8
Map to PDO	No	

Remarks

Changes in mapping are only possible in NMT state pre-operational. Before it is possible to enable PDO, it is necessary to map objects.

Value	Description
0	PDO is disabled
1-8	One to eight objects are mapped

Name	1st mapped object	
Index	0x1A03	
Subindex	0x01	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0x60400010	
Value range	-	-
Map to PDO	No	

Name	2nd mapped object	
Index	0x1A03	
Subindex	0x02	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	3rd mapped object	
Index	0x1A03	
Subindex	0x03	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	4th mapped object	
Index	0x1A03	
Subindex	0x04	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	5th mapped object	
Index	0x1A03	
Subindex	0x05	
Type	UNSIGNED32	

Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	<i>No</i>	

Name	7th mapped object	
Index	0x1A03	
Subindex	0x07	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	<i>No</i>	

Name	8th mapped object	
Index	0x1A03	
Subindex	0x08	
Type	<i>UNSIGNED32</i>	
Access	<i>RW</i>	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	<i>No</i>	

Description

The objects that are supported to map are marked in each object Id description at the bottom area of table description: Map to PDO.

Remarks

Changes in mapping are only possible in NMT state pre-operational. To change a mapped object it is necessary to disable PDO. The maximal length of a process data object is 64 bit; because of this it is only possible to map two 32-bit values or two 16-bit values and one 32-bit value and so on.

8.30 0x2001 CAN Bitrate

Name	CAN bitrate	
Index	0x2001	
Subindex	0x00	
Type	<i>UNSIGNED16</i>	
Access	<i>RW</i>	
Stored in EEPROM	Yes	
Default Value	500	
Value range	-	-
Map to PDO	<i>No</i>	

Description

The bit rate of the CAN interface can be changed with the CAN bitrate parameter.

Remarks

The changes to this object take only effect after restart. Therefore it's necessary to store all parameters after changing and then restart.

Value	Bit rate
20	20 kbit/s
50	50 kbit/s
125	125 kbit/s
250	250 kbit/s
500	500 kbit/s
800	800 kbit/s
1000	1Mbit/s

8.31 0x2002 RS232

Name	RS232 baudrate	
Index	0x2002	
Subindex	0x00	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	115200	
Value range	-	-
Map to PDO	No	

Description

The baud rate of the serial communication interface can be changed with the RS232 baudrate parameter.

8.32 0x2003 CPU load

Name	CPU load	
Index	0x2003	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	Yes	
Default Value	-	
Value range	0	100
Map to PDO	No	

Description:

Calculated CPU load displayed in this object.

8.33 0x200C Custom persistent memory

Name	Custom persistent memory
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Index	<i>0x200C</i>
Number of entries	12

Name	Custom persistent memory unsigned-8 1	
Index	<i>0x200C</i>	
Subindex	<i>0x01</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0</i>	
Value range	-	-
Map to PDO	<i>No</i>	

Name	Custom persistent memory unsigned-8 2	
Index	<i>0x200C</i>	
Subindex	<i>0x02</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0</i>	
Value range	-	-
Map to PDO	<i>No</i>	

Name	Custom persistent memory signed-8 1	
Index	<i>0x200C</i>	
Subindex	<i>0x03</i>	
Type	<i>INTEGER8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0</i>	
Value range	-	-
Map to PDO	<i>No</i>	

Name	Custom persistent memory signed-8 2	
Index	<i>0x200C</i>	
Subindex	<i>0x04</i>	
Type	<i>INTEGER8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0</i>	
Value range	-	-
Map to PDO	<i>No</i>	

Name	Custom persistent memory unsigned-16 1	
Index	<i>0x200C</i>	
Subindex	<i>0x05</i>	
Type	<i>UNSIGNED16</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0</i>	
Value range	-	-

Map to PDO	No	
Name	Custom persistent memory unsigned-16 2	
Index	0x200C	
Subindex	0x06	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	
Name	Custom persistent memory signed-16 1	
Index	0x200C	
Subindex	0x07	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	
Name	Custom persistent memory signed-16 2	
Index	0x200C	
Subindex	0x08	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	
Name	Custom persistent memory unsigned-32 1	
Index	0x200C	
Subindex	0x09	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	
Name	Custom persistent memory unsigned-32 2	
Index	0x200C	
Subindex	0x0A	
Type	UNSIGNED32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	

Name	Custom persistent memory signed-32 1	
Index	0x200C	
Subindex	0x0B	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	
Name	Custom persistent memory signed-32 2	
Index	0x200C	
Subindex	0x0C	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-	-
Map to PDO	No	

Description

This persistent memory can be used to store custom values. These values would not be evaluated by the firmware, but they will be cleared by setting default parameters.

8.34 0x200F Phase A current

Name	Phase A current	
Index	0x200F	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	-32767
Map to PDO	Yes	

Description

Actual measured current on phase A in quants.

8.35 0x2010 Phase B current

Name	Phase B current	
Index	0x2010	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	-32767

Map to PDO	Yes
-------------------	-----

Description

Actual measured current of phase B in quants.

8.36 0x201A Current demand

Name	Current demand	
Index	0x201A	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	-32767
Map to PDO	Yes	

Description

The desired value of motor current which is inserted into current regulator in 1/1000 Motor rated current.

Object is read only and is set according selected mode of operation.

In test modes of operation current limitation is not done.

8.37 0x201B Torque regulator

Name	Torque regulator	
Index	0x201B	
Number of entries	-	

Name	Number of entries	
Index	0x201B	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	7	
Value range	0	255
Map to PDO	No	

Name	Torque regulator requested	
Index	0x201B	
Subindex	0x01	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only and is calculated from Current demand 0x201A in quants.

Name	Torque regulator actual	
Index	0x201B	
Subindex	0x02	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only in quants.

Name	Torque regulator out	
Index	0x201B	
Subindex	0x03	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only in quants. Value is output of the regulator.

Name	Torque regulator error	
Index	0x201B	
Subindex	0x04	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only in quants. Value is presenting error – difference between requested and actual value.

Name	Calculated fly on torque regulator-I	
Index	0x201B	
Subindex	0x05	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only in 1/sec. Calculated value is used for fly on initialization of I part of torque regulator.

Name	Calculated fly on torque regulator-P	
Index	0x201B	
Subindex	0x06	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

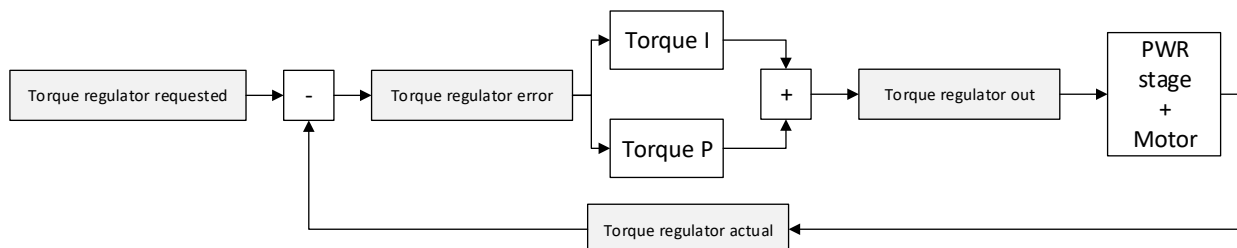
Description:

Object is read only in 1/1000. Calculated value is used for fly on initialization of P part of torque regulator.

Name	Calculated fly on torque internal	
Index	0x201B	
Subindex	0x07	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only in quants. Calculated value is used for fly on initialization of internal value in torque regulator.

**8.38 0x201C Flux regulator**

Name	Flux regulator
Index	0x201C
Number of entries	-

Name	Number of entries
Index	0x201C
Subindex	0x00
Type	UNSIGNED8

Access	<i>RO</i>	
Stored in EEPROM	-	
Default Value	7	
Value range	0	255
Map to PDO	<i>No</i>	

Name	Flux regulator requested	
Index	<i>0x201C</i>	
Subindex	<i>0x01</i>	
Type	<i>INTEGER16</i>	
Access	<i>RO</i>	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	<i>Yes</i>	

Description:

Object is read only in quants.

Name	Flux regulator actual	
Index	<i>0x201C</i>	
Subindex	<i>0x02</i>	
Type	<i>INTEGER16</i>	
Access	<i>RO</i>	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	<i>Yes</i>	

Description:

Object is read only in quants.

Name	Flux regulator out	
Index	<i>0x201C</i>	
Subindex	<i>0x03</i>	
Type	<i>INTEGER16</i>	
Access	<i>RO</i>	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	<i>Yes</i>	

Description:

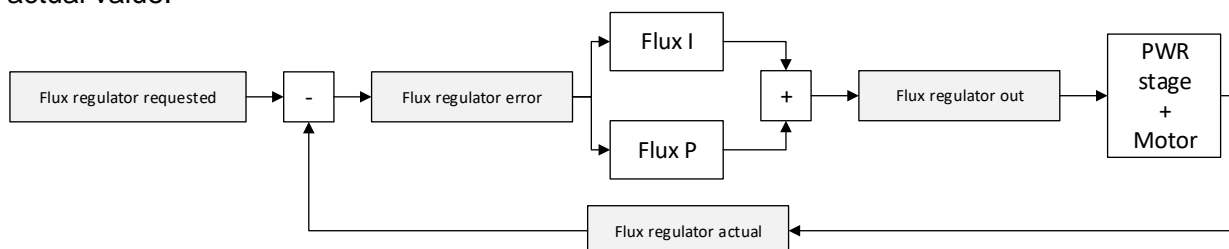
Object is read only in quants. Value is output of the regulator.

Name	Flux regulator error	
Index	<i>0x201C</i>	
Subindex	<i>0x04</i>	
Type	<i>INTEGER16</i>	
Access	<i>RO</i>	
Stored in EEPROM	-	
Default Value	-	

Value range	-32768	32767
Map to PDO	Yes	

Description:

Object is read only in quants. Value is presenting error – difference between requested and actual value.

**8.39 0x201D Motor Field Settings**

Name	Motor Field Settings	
Index	0x201D	
Number of entries	-	

Name	Number of entries	
Index	0x201D	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	6	
Value range	0	255
Map to PDO	No	

Name	PMSM Flux mode	
Index	0x201D	
Subindex	0x01	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	0	
Value range	0	255
Map to PDO	No	

Description:

emDrive si supporting different field weakening modes:

- 0 - no field weakening
- 1 - Manual field weakening
- 2 - Auto field weakening

Name	PMSM Flux Manual current	
Index	0x201D	
Subindex	0x02	
Type	INTEGER32	
Access	RO	

Stored in EEPROM	-	
Default Value	0	
Value range	0	255
Map to PDO	No	

Description:

Negative is field weakening, positive is field reinforcement
in auto mode this is maximum field weakening current

Name	Flux actual current	
Index	0x201D	
Subindex	0x03	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	0	
Value range	0	255
Map to PDO	No	

Description:

Positive is field weakening, value is actual field weakening current, value displayed in quants.

Name	Flux I increment	
Index	0x201D	
Subindex	0x04	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	0	
Value range	0	255
Map to PDO	No	

Description:

When motor is transitioning from normal operation to field weakening this is gain for adding flux current, unit: mA/s.

Name	Flux pulse mode counter	
Index	0x201D	
Subindex	0x05	
Type	UNSIGNED16	
Access	RO	
Stored in EEPROM	-	
Default Value	0	
Value range	0	255
Map to PDO	No	

Description:

Used for tuning Flux current regulator. Internal value is incremented each FOC cycle, when this value is higher than entered value in this parameter flux current is inverted.

Name	Flux pulse mode num of pulses
-------------	--------------------------------------

Index	<i>0x201D</i>	
Subindex	<i>0x06</i>	
Type	<i>UNSIGNED16</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>0</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Description:

Number how many times current is inverted (refer to Flux pulse mode counter).

8.40 0x201E BMS Data

Name	Flux regulator	
Index	<i>0x201E</i>	
Number of entries	<i>-</i>	

Name	Number of entries	
Index	<i>0x201E</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>2</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Name	BMS Battery Voltage	
Index	<i>0x201E</i>	
Subindex	<i>0x01</i>	
Type	<i>INTEGER32</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>-</i>	
Value range	<i>0</i>	<i>65535</i>
Map to PDO	<i>NO</i>	

Description:

Value is read only in Volts. It's the sum of all cell voltages, representing total battery voltage.

Name	BMS min cell voltage	
Index	<i>0x201E</i>	
Subindex	<i>0x02</i>	
Type	<i>INTEGER32</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>-</i>	
Value range	<i>0</i>	<i>65535</i>
Map to PDO	<i>NO</i>	

Description:

Minimum cell voltage in mV.

Name	BMS min cell voltage ID	
Index	0x201E	
Subindex	0x03	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Index of minimum cell voltage.

Name	BMS max cell voltage	
Index	0x201E	
Subindex	0x04	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Maximum cell voltage in mV.

Name	BMS max cell voltage ID	
Index	0x201E	
Subindex	0x05	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Index of maximum cell voltage.

Name	BMS battery current	
Index	0x201E	
Subindex	0x06	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Value is read only in mA. Positive value when current flows into battery.

Name	BMS unit temperature	
Index	0x201E	
Subindex	0x07	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Value is read only in °C.

Name	BMS state of charge	
Index	0x201E	
Subindex	0x08	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Value is read only in %.

Name	BMS charging	
Index	0x201E	
Subindex	0x09	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Indication if charger is present:

1 - charger connected, 0 - charger not connected.

Name	BMS battery charging current	
Index	0x201E	
Subindex	0x0A	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

When charging, value is charging current in mA.

Name	BMS proposed power	
Index	0x201E	
Subindex	0x0B	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	0	65535
Map to PDO	NO	

Description:

Propose power is calculated from minimum cell voltage of battery stack and external temperature. If minimum cell voltage is below value of parameter Ucell power decreasing (BMS parameters) then the BMS starts to decreasing power. Also if temperature is out of range BMS is decreasing propose power.

When BMS starts to decreasing proposed power, warning LED become active and motor current will be limited.

Value in %.

8.41 0x201F Electrical angle

Name	Electrical angle	
Index	0x201F	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Value is in quants, representing raw rotor position, get from feedback. If stepper is enabled position is stepper position.

Used in FOC.

8.42 0x2021 Safety execute

Name	Safety execute	
Index	0x2021	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	Yes	
Default Value	0	
Value range	0	2

Map to PDO

No

Description:

Safety procedure will be executed according entered value:

Value	Description
0	Execute always
1	Execute only when motor is stopped
2	Never execute
3..255	Reserved

8.43 0x2022 Hall sensor

Name	Flux regulator
Index	0x2022
Number of entries	-

Name	Number of entries
Index	0x201B
Subindex	0x00
Type	UNSIGNED8
Access	RO
Stored in EEPROM	-
Default Value	2
Value range	0 255
Map to PDO	No

Name	Hall sensor bit pattern
Index	0x2022
Subindex	0x01
Type	UNSIGNED16
Access	RO
Stored in EEPROM	-
Default Value	-
Value range	0 65535
Map to PDO	NO

Description:

Direct value on microprocessor Hall input pins. If halls are working correctly number from 1-6 will appear, 0 and 7 are invalid states in 120° hall configuration.

Name	Hall noise counter
Index	0x2022
Subindex	0x02
Type	INTEGER32
Access	RO
Stored in EEPROM	-
Default Value	-
Value range	-21474283648 21474283647
Map to PDO	NO

Description:

Used for identification of HALL errors. Each time when error is detected value is increased. Object is read only and it's not used in FOC.

8.44 0x2023 DC current

Name	DC current	
Index	0x2023	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-21474283648	21474283647
Map to PDO	Yes	

Description:

DC current in mA. Motor current is measured each FOC cycle, averaging is performed each velocity loop from which DC current is calculated.

8.45 0x2024 Electric power

Name	Electric power	
Index	0x2024	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-21474283648	21474283647
Map to PDO	Yes	

Description:

Calculated from DC current and DC voltage value in W.

8.46 0x2025 Motor temperature

Name	Motor temperature	
Index	0x2025	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	0	255
Map to PDO	Yes	

Description:

Actual motor temperature calculated from input pin on microprocessor value in °C. Proper sensor type must be selected, if displayed value is 200 there is an error on sensor – not connected or wrong type.

8.47 0x2026 Controller temperature

Name	Controller temperature	
Index	0x2026	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	0	255
Map to PDO	Yes	

Description:

Actual controller temperature – internal sensor, value in °C.

8.48 0x2027 Warnings

Name	Warnings	
Index	0x2027	
Subindex	0x00	
Type	UNSIGNED16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	0	65535
Map to PDO	Yes	

Description:

If any of protections are active corresponding bit is set.

Bit	7	6	5	4	3	2	1	0
Description	x	Max velocity exceeded	Stall protection active	DC over current	DC link over voltage	DC link under voltage	Motor temperature exceeded	Controller temperature exceeded

8.49 0x2028 Motor current limit

Name	Motor current limit	
Index	0x2028	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	

Value range	-32768	32767
Map to PDO	Yes	

Description:

Maximum motor current – output current after limitations in 1/1000 controller rated current.
If any of warning are active, highest limitation is determining this value.

8.50 0x2029 Logic power supply voltage

Name	Logic power supply	
Index	0x2029	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Internally measured logic supply voltage in V.

8.51 0x2031 Test mode command

Name	Test mode command	
Index	0x2031	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	0	1000
Map to PDO	Yes	

Description:

Different functionality according test mode of operation. For detailed description refer modes of operation chapter.

8.52 0x2032 Pulse mode

Name	Pulse mode	
Index	0x2032	
Number of entries	-	

Name	Number of entries	
Index	0x2032	
Subindex	0x00	

Type	<i>UNSIGNED8</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>2</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Name	Pulse mode counter	
Index	<i>0x2032</i>	
Subindex	<i>0x01</i>	
Type	<i>UNSIGNED16</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>0</i>	
Value range	<i>0</i>	<i>65535</i>
Map to PDO	<i>Yes</i>	

Description:

When internal counter value is exceeded polarity of motor current is inverted. Inverting value is selectable by Modes of operation. Used for regulator fine tuning and testing purposes.

Name	Pulse mode number of pulses	
Index	<i>0x2032</i>	
Subindex	<i>0x02</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>-</i>	
Default Value	<i>0</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>Yes</i>	

Description:

Set number of pulses when inverting current or velocity – inverting value is selectable by modes of operation. When number of pulses is exceeded error PULSE MODE FINISHED is displayed if entered value is 0, number of pulses is not limited.

Used for regulator fine tuning and testing purposes.

8.53 0x2033 Motor pole pairs

Name	Motor pole pairs	
Index	<i>0x2033</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED8</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>6</i>	
Value range	<i>0</i>	<i>255</i>
Map to PDO	<i>No</i>	

Description:

Number of motor pole pairs, must be set by user.

8.54 0x2034 Motor type

Name	Motor type	
Index	0x2034	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	NO	
Default Value	0	
Value range	-	-
Map to PDO	Yes	

Description:

Used for selecting motor type:

0 – PMS motor

1 – induction motor

8.55 0x2040 Feedback config

Name	Feedback config	
Index	0x2040	
Number of entries	-	

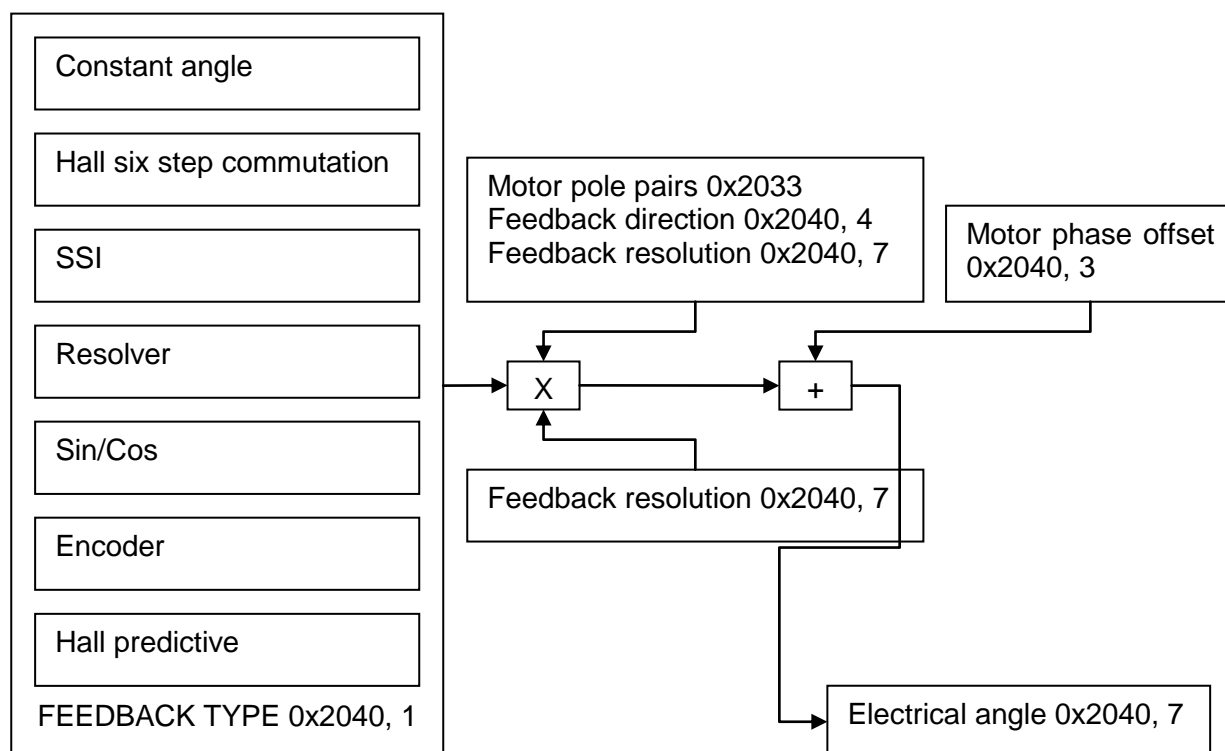
Name	Number of entries	
Index	0x2040	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	13	
Value range	0	255
Map to PDO	No	

Name	Feedback type	
Index	0x2040	
Subindex	0x01	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	3	
Value range	0	6
Map to PDO	No	

Description:

Used for selection of proper feedback:

Value	0	1	2	3	4	5	6
Description	Constant angle	Hall six step	SSI	Resolver	Sin/cos	Encode	Hall predictive



Name	Motor hase offset	
Index	0x2040	
Subindex	0x02	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	55	
Value range	-180	180
Map to PDO	No	

Description:

Rotor position offset of feedback sensor in degrees. Can be measured or set over modes of operation – Auto aligning rotor position.

Name	Feedback direction	
Index	0x2040	
Subindex	0x03	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1	
Value range	0	1
Map to PDO	No	

Description:

If 1 is entered feedback position is inverted, 0 is not inverting feedback position.

Name	Test stepper frequency
-------------	-------------------------------

Index	0x2040	
Subindex	0x04	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	10	
Value range	1	100
Map to PDO	No	

Description:

Used in test mode of operation if stepper is enabled this value is used in Hz.

Name	Hall configuration	
Index	0x2040	
Subindex	0x05	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	10	
Value range	1	100
Map to PDO	No	

Description:

0 – 120° hall configuration selected

1 – 60° hall configuration selected

Name	Feedback Resolution	
Index	0x2040	
Subindex	0x06	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	4096	
Value range	6	8192
Map to PDO	No	

Description:

Enter feedback resolution provided by feedback producer, if halls are used resolution is 6.

Name	Electrical angle filter	
Index	0x2040	
Subindex	0x07	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	0	1024
Map to PDO	No	

Description:

Value enables filter with corner frequency 1Hz, 10 Hz or 100 Hz

Value	Description
-------	-------------

0	Filter off
1	1 Hz
2	10 Hz
3	100 Hz

Filter with 1 Hz of corner frequency seriously decrease dynamics, use only in low dynamic systems.

Name	Motor phase offset compensation	
Index	0x2040	
Subindex	0x08	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-32768	32767
Map to PDO	No	

Description:

Position delay in μ s.

Name	Test stepper enable	
Index	0x2040	
Subindex	0x09	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	0	1
Map to PDO	No	

Description:

Used for enabling steeper angle instead of feedback angle.

Name	Auto aligning rotor position current	
Index	0x2040	
Subindex	0x010	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1000	
Value range	0	2000
Map to PDO	No	

Description:

Value set motor current which is used in mode of operation – auto aligning rotor position. Value in 1/1000 Motor rated current.

8.56 0x2050 Maximum controller current

Name	Maximum controller current
-------------	-----------------------------------

Index	0x2050	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	250000	
Value range	10000	600000
Map to PDO	Yes	

Description:

Value is determining global maximum motor current for controller.

8.57 0x2051 Secondary current protection

Name	Secondary current protection	
Index	0x2051	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	300000	
Value range	50000	650000
Map to PDO	Yes	

Description:

This protection is last stage of protection. It must not be changed – it's set according HW limitations.

8.58 0x2052 Velocity control parameter

Name	Velocity control parameter	
Index	0x2052	
Number of entries	-	

Name	Number of entries	
Index	0x2052	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Maximum velocity	
Index	0x2052	
Subindex	0x01	
Type	INTEGER32	

Access	<i>RW</i>	
Stored in EEPROM	Yes	
Default Value	5000	
Value range	1	2147483647
Map to PDO	Yes	

Description:

Value is determining maximum velocity of motor in RPM. If value is exceeded motor current will be limited.

Name	Maximum velocity gain	
Index	0x2052	
Subindex	0x01	
Type	INTEGER16	
Access	<i>RW</i>	
Stored in EEPROM	Yes	
Default Value	10	
Value range	0	100
Map to PDO	Yes	

Description:

If Maximum velocity parameter is exceeded current will be limited according entered value in A/RPM. If entered value is 0 limitation is disabled.

8.59 0x2053 DC current limit

Name	DC current limit	
Index	0x2053	
Number of entries	-	

Name	Number of entries	
Index	0x2053	
Subindex	0x00	
Type	UNSIGNED8	
Access	<i>RO</i>	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Maximum DC current	
Index	0x2053	
Subindex	0x01	
Type	INTEGER32	
Access	<i>RW</i>	
Stored in EEPROM	Yes	
Default Value	250000	
Value range	1000	250000
Map to PDO	Yes	

Description:

Maximum DC current in mA. If current is exceeded limit of motor current will be active. Limitation gain is determined in Maximum DC current gain. If enter value is 0, limit is not active.

Name	Maximum DC current gain	
Index	0x2053	
Subindex	0x01	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	10	
Value range	0	100
Map to PDO	Yes	

Description:

When DC current is exceeding Maximum DC current, limit will become active.

For each Amper over the Maximum DC current, controller current will be reduced for entered value (in $1/1000_{\text{max_controller_current}}$).

Example:

Maximum DC current = 100000mA

Maximum DC current gain = 50

Actual DC current = 110A

Calculated Max Controller current = $(110 \text{ A} - 100000\text{mA}) * 50 = 500$

This means that maximum controller current is reduced to $500/1000 = 0,5$ max controller current

8.60 0x2054 Overvoltage limit

Name	Overvoltage limit	
Index	0x2054	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	60	
Value range	0	63
Map to PDO	Yes	

Description:

If DC link voltage is exceeded drive functionality is disabled and error DC link overvoltage is active. In $1/10\text{V}$

8.61 0x2055 Undervoltage limitation parameter

Name	Undervoltage limitation parameter	
Index	0x2055	
Number of entries	-	

Name	Number of entries	
Index	0x2055	

Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	3	
Value range	0	255
Map to PDO	No	

Name	Undervoltage Limit	
Index	0x2055	
Subindex	0x01	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	40	
Value range	0	63
Map to PDO	No	

Description:

DC link voltage below this value will start limiting motor current. If entered value is 0 limit is disabled. Value is in V.

Name	Undervoltage gain	
Index	0x2055	
Subindex	0x02	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	20	
Value range	0	100
Map to PDO	No	

Description:

When DC link voltage is lower than Undervoltage Limit, limit will become active.

For each Volt under the undervoltage limit maximum controller will be reduced for entered value (in $1/1000_{\text{max_controller_current}}$).

Example:

Undervoltage limit = 100 V

Undervoltage gain = 50

DC voltage = 90A

Calculated Max Controller current = $(100 \text{ V} - 90 \text{ V}) * 50 = 500$;

This means that maximum controller current is reduced to $500/1000 = 0,5$ max controller current.

Name	Undervoltage min voltage	
Index	0x2055	
Subindex	0x03	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	33	

Value range	0	63
Map to PDO	No	

Description:

If DC link voltage will be lower that entered in V, drive mode will be disabled and under voltage error will appear.

8.62 0x2057 Motor temperature config

Name	Motor temperature config	
Index	0x2057	
Number of entries	-	

Name	Number of entries	
Index	0x2057	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	3	
Value range	0	255
Map to PDO	No	

Name	Motor temperature sensor type	
Index	0x2057	
Subindex	0x01	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	2	
Value range	0	4
Map to PDO	No	

Description:

value	Temperature sensor type
0	No sensor (displayed temperature will always be 25°C – no temperature protection for motor)
1	NTC 10k
2	KTY 84-130
3	KTY 81-210
4..255	reserved

Name	Motor maximum temperature	
Index	0x2057	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	100	

Value range	50	150
Map to PDO	No	

Description:

If motor temperature is exceeding entered value in °C controller current will be limited. If entered value is 0 limit is not active.

Name	Motor maximum temperature gain	
Index	0x2057	
Subindex	0x03	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	10	
Value range	0	10
Map to PDO	No	

Description:

When Motor temperature is lower than Motor maximum temperature, limit will become active. For each °C under the Motor maximum temperature maximum controller will be reduced for entered value (in $1/1000_{\text{max_controller_current}}$).

Example:

Motor maximum temperature = 100°C

Motor maximum temperature gain = 50

Motor temperature = 110°C

Calculated Max Controller current = $(100^{\circ}\text{C} - 90^{\circ}\text{C}) * 50 = 500$;

This means that maximum controller current is reduced to $500/1000 = 0,5$ max controller current.

8.63 0x205B Stall Config

Name	Stall Config	
Index	0x205B	
Number of entries	-	

Name	Number of entries	
Index	0x205B	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	3	
Value range	0	255
Map to PDO	No	

Name	Stall protection time	
Index	0x205B	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	

Stored in EEPROM	Yes	
Default Value	5	
Value range	0	100
Map to PDO	No	

Description:

Stall is detected when motor is not commutating for time entered here in seconds and current is higher than value set in Stall protection current (0x205C, 0).

Name	Stall protection current	
Index	0x205B	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	500	
Value range	100	1000
Map to PDO	No	

Description:

If motor current exceed entered value in 1/10A and motor is not commutating for time longer than value entered in Stall protection time (0x205B, 0) maximum controller will be reduced to entered value.

8.64 0x2060 OC out config

Name	Local control config	
Index	0x2060	
Number of entries	-	

Name	Number of entries	
Index	0x2060	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	OC out 1 enable	
Index	0x2060	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1	
Value range	0	2
Map to PDO	No	

Name	OC out 2 enable	
Index	0x2060	
Subindex	0x03	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1	
Value range	0	2
Map to PDO	No	

8.65 0x2061 Brake config

Name	Brake config	
Index	0x2061	
Number of entries	-	

Name	Number of entries	
Index	0x2061	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	3	
Value range	0	255
Map to PDO	No	

Name	Brake nominal voltage	
Index	0x2061	
Subindex	0x01	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	24	
Value range	6	48
Map to PDO	No	

Description:

Entered value set nominal output voltage on OC1 and OC2 output in V if break functionality is selected with object OC1/2 out enable (0x2060, 2/3).

Name	Brake reduced voltage	
Index	0x2061	
Subindex	0x02	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	12	
Value range	6	48
Map to PDO	No	

Description:

Entered value set reduced voltage on OC1 and OC2 output in V if break functionality is selected with object OC1/2 out enable (0x2060, 2/3), after time defined in Brake time to reduce voltage (0x2061,3).

Name	Brake time to reduce voltage	
Index	0x2061	
Subindex	0x03	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	-	
Default Value	12	
Value range	6	48
Map to PDO	No	

Description:

After entered value in seconds OC1/2 reduced voltage will be set on OC1/2 output if break functionality is selected with object OC1/2 out enable (0x2060, 2/3).

8.66 0x6070 Analog inputs

Name	Analog inputs	
Index	0x2070	
Number of entries	-	

Name	Number of entries	
Index	0x2070	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	3	
Value range	0	255
Map to PDO	No	

Name	Throttle voltage	
Index	0x2070	
Subindex	0x01	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Value measured on microprocessor throttle AD input pin in mV.

Name	Aux voltage	
Index	0x2070	

Subindex	0x02	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Voltage measured on microprocessor Aux AD input pin in mV.

Name	Brake voltage	
Index	0x2070	
Subindex	0x03	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Voltage measured on microprocessor Brake AD pin in mV

8.67 0x2072 AD resolver

Name	AD resolver	
Index	0x2072	
Number of entries	-	

Name	Number of entries	
Index	0x2072	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	AD resolver sin	
Index	0x2072	
Subindex	0x01	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	-	
Value range	-32768	32767
Map to PDO	Yes	

Description:

Voltage measured on input AD pin resolver sin in quants.

Name	AD resolver cos		
Index	0x2072		
Subindex	0x02		
Type	INTEGER16		
Access	RO		
Stored in EEPROM	-		
Default Value	-		
Value range	-32768		32767
Map to PDO	Yes		

Description:

Voltage measured on input AD pin resolver cos in quants.

8.68 0x2076 Digital inputs

Name	Digital Inputs		
Index	0x2076		
Subindex	0x00		
Type	UNSIGNED8		
Access	RO		
Stored in EEPROM	No		
Default Value	-		
Value range	0		65535
Map to PDO	Yes		

Description:

The output values are given in the object Digital Values. Corresponding flag is set in object. Polarity of digital input is here already incorporated.

emDrive 400:

Din num.	Reserved										Din6	Din5	Din4	Din3	Din2	Din1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

emDrive150, EmDrive H300:

Din num.	Reserved												Din3	Din2	Din1	
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

8.69 0x2085 Actual FOC angle

Name	Actual FOC angle		
Index	0x2085		
Subindex	0x00		
Type	UNSIGNED8		
Access	RO		

Stored in EEPROM	No	
Default Value	-	
Value range	0	65535
Map to PDO	Yes	

Description:

It is angle which is actually used in FOC.

Example:

Selected feedback in Feedback Type (0x2040, 0x01) is SSI and stepper is enabled. Value in Actual FOC angle is stepper angle, but value in Electrical angle (0x201f, 0x00) is actually angle from SSI feedback.

8.70 0x2086 Velocity actual value averaged

Name	Velocity actual value averaged	
Index	0x2086	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	0	65535
Map to PDO	Yes	

Description:

Over 1 second averaged Velocity actual value (0x606c, 0). Used for more accurate velocity reading if resolution of feedback is low.

8.71 0x2091 Induction motor config

Name	Induction motor config	
Index	0x2091	
Number of entries	-	

Name	Number of entries	
Index	0x2091	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	10	
Value range	0	255
Map to PDO	No	

Name	Induction motor rotor time constant	
Index	0x2091	
Subindex	0x01	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	70000	
Value range	100	1000000
Map to PDO	Yes	

Description:

R_1	stator resistance
X_1	stator leakage reactance
X_m	magnetizing reactance
R_c	machine core loss resistor
X_2	rotor leakage reactance
R_2	rotor resistance

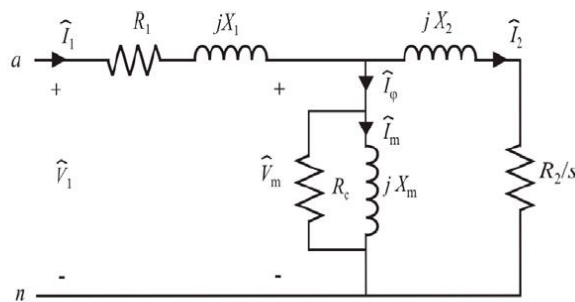


Figure 1. Per-phase equivalent circuit of an induction motor.

Rotor time constant [s] = $(L_m + L_2)/R_2$

Name	Induction motor rated velocity	
Index	0x2091	
Subindex	0x02	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	3000	
Value range	0	2147483647
Map to PDO	Yes	

Description:

Used for entering the field weakening. When velocity is exceeding this value Flux is reduced.

Name	Induction motor Flux control mode	
Index	0x2091	
Subindex	0x03	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1	
Value range	0	0
Map to PDO	Yes	

Description:

Value	Description
0	Flux current is constant
1	Flux current is reduced according velocity parameter (Induction rated velocity)
2	Flux current is automatically reduced when Motor phase voltage reaches DC link voltage

Name	Induction motor V to Hz ratio	
Index	0x2091	
Subindex	0x04	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	0	1
Map to PDO	Yes	

Description:

Parameter is used in VF modes of operation.

Name	Induction motor rated flux current	
Index	0x2091	
Subindex	0x05	
Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	155	
Value range	1	10000
Map to PDO	Yes	

Description:

In Flux control mode “0” (constant flux) value of this parameter is determining flux current.

In Flux control mode “2” (automatic flux control) flux current is never reduced lower than 1/3 of the value of this parameter.

Name	Induction motor parameter flux regulator P gain	
Index	0x2091	
Subindex	0x06	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1000	
Value range	1	1000
Map to PDO	No	

Description:

Gain for P part of flux current PI regulator in units 1/1000.

Name	Induction motor parameter flux regulator I gain	
Index	0x2091	
Subindex	0x07	

Type	<i>INTEGER16</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>200</i>	
Value range	<i>1</i>	<i>23767</i>
Map to PDO	<i>No</i>	

Description:

Gain for I part of flux current PI regulator in units 1/second.

8.72 0x603F Error code

Name	Error Code	
Index	<i>0x603F</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED16</i>	
Access	<i>RO</i>	
Stored in EEPROM	<i>Yes</i>	
Default Value	<i>0</i>	
Value range	<i>0</i>	<i>65535</i>
Map to PDO	<i>Yes</i>	

Description

In this object error code is displayed if drive goes into error mode. You can find error code description in 4.2 Device Emergency Error Codes paragraph.

8.73 0x6040 Controlword

Name	Controlword	
Index	<i>0x6040</i>	
Subindex	<i>0x00</i>	
Type	<i>UNSIGNED16</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>No</i>	
Default Value	<i>0</i>	
Value range	<i>0</i>	<i>65535</i>
Map to PDO	<i>Yes</i>	

Description

The controlword consists of bits for:

- The Table 2-2: Command coding (bits 0-3 and 7)
- The controlling of operation modes (bits 4-6 and 8) (State Transitions on page 11)

8.74 0x6041 Statusword

Name	Statusword	
Index	<i>0x6041</i>	
Subindex	<i>0x00</i>	

Type	UNSIGNED16	
Access	RW	
Stored in EEPROM	No	
Default Value	-	
Value range	0	65535
Map to PDO	Yes	

Description

Data description

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

Bits in the statusword

Bit	Description	M/O
0	Ready to switch on	M
1	Switched on	M
2	Operation enabled	M
3	Fault	M
4	Voltage enabled	M
5	Quick stop	M
6	Switch on disabled	M
7	Warning	O
8	Manufacturer specific	O
9	Remote	M
10	Target reached	M
11	Internal limit active	M
12-13	Operation mode specific	O
14-15	Manufacturer specific	O

BIT 4: VOLTAGE ENABLED

High voltage is applied to the drive when this bit is set to 1.

BIT 5: QUICK STOP

When reset, this bit indicates that the drive is reacting on a quick stop request. Bits 0, 1 and 2 of the *statusword* must be set to 1 to indicate that the drive is capable to regenerate. The setting of the other bits indicates the status of the drive (e.g. the drive is performing a quick stop as result of a reaction to a non-fatal fault. The fault bit is set as well as bits 0, 1 and 2).

BIT 7: WARNING

A drive warning is present if bit 7 is set. The cause means no error but a state that has to be mentioned, e.g. temperature limit, job refused. The status of the drive does not change. The cause of this warning may be found by reading the fault code parameter. The bit is set and reset by the device.

BIT 8:

This bit may be used by a drive manufacturer to implement any manufacturer specific functionality.

BIT 9: REMOTE

If bit 9 is set, then parameters may be modified via the CAN-network, and the drive executes the content of a command message. If the bit remote is reset, then the drive is in local mode and will not execute the command message. The drive may transmit messages containing valid actual values like a *position actual value*, depending on the actual drive configuration. The drive will accept accesses via SDO in local mode.

BIT 10: TARGET REACHED

If bit 10 is set by the drive, then a set-point has been reached. The set-point is dependent on the operating mode. The description is situated in the chapter of the special mode. The change of a target value by software alters this bit.

If *quick stop option code* is 5, 6, 7 or 8, this bit must be set, when the quick stop operation is finished and the drive is halted.

If halt occurred and the drive has halted then this bit is set too.

BIT 11: INTERNAL LIMIT ACTIVE

This bit set by the drive indicates, that an internal limitation is active (e.g. *position range limit*).

BIT 12 AND 13:

These bits are operation mode specific. The description is situated in the chapter of the special mode

The following table gives an overview:

Mode specifics bits in the status word

Bit	Operation mode					
	vl	pp	pV	tq	hm	ip
12	Reserved	Set-point acknowledge	Speed	Reserved	Homing attained	Ip mode active
13	Reserved	Following error	Max slippage error	Reserved	Homing error	Reserved

BIT 14 AND 15:

These bits may be used by a drive manufacturer to implement any manufacturer specific functionality.

8.75 0x605A Quick stop option code

Name	Quick stop option code
Index	0x605A
Subindex	0x00
Type	INTEGER16
Access	RW
Stored in EEPROM	No
Default Value	0

Value range	-32768	32767
Map to PDO	No	

Description

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

Data description

Value	Description
-32768... -1	Manufacturer specific
0	Disable drive function
1	Slow down on slow ramp slow down on quick stop ramp
2	Slow down on current limit
3	Slow down on the current limit
4	Slow down on the voltage limit
5	Slow down on slow down ramp and stay in QUICK STOP
6	Slow down on quick stop ramp and stay in QUICK STOP
7	Slow down on the current limit and stay in QUICK STOP
8	Slow down on the voltage limit and stay in QUICK STOP
9... 32767	Reserved

8.76 0x605b Shut down option code

Name	Shut down option code	
Index	0x605B	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	No	
Default Value	0	
Value range	-32768	32767
Map to PDO	No	

Description

The parameter shutdown option code determines what action should be taken if there is a transition

OPERATION ENABLE ⇒ READY TO SWITCH ON.

Data description

Value	Description
-32768... -1	Manufacturer specific
0	Disable drive function
1	Slow down with slow down ramp; disable of the drive function
2... 32767	Reserved

8.77 0x605C Disable operation option code

Name	Disable operation option code
Index	0x605C

Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	No	
Default Value	0	
Value range	-32768	32767
Map to PDO	No	

Description

The parameter disable operation option code determines what action should be taken if there is a transition

OPERATION ENABLE ⇒ SWITCHED ON.

Data description

Value	Description
-32768... -1	Manufacturer specific
0	Disable drive function
1	Slow down with slow down ramp and then disabling of the drive function
2... 32767	Reserved

8.78 0x605E Fault reaction option code

Name	Fault reaction option code	
Index	0x605E	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	No	
Default Value	0	
Value range	-32768	32767
Map to PDO	No	

Description

The parameter fault reaction option code determines what action should be taken if a fault occurs in the drive.

Data description

Value	Description
-32768... -1	Manufacturer specific
0	Disable drive, motor is free rotating
1	Slow down on slow down ramp
2	Slow down on quick stop ramp
3	Slow down on the current limit
4	Slow down on the voltage limit
5... 32767	reserved

8.79 0x6060 Modes of operation

Name	Modes of operation
Index	0x6060

Subindex	0x00	
Type	INTEGER8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-128	127
Map to PDO	Yes	

Description

Detailed description in section 5.1.1 0x6060: Modes of operation.

8.80 0x6061 Modes of operation display

Name	Modes of operation display	
Index	0x6061	
Subindex	0x00	
Type	INTEGER8	
Access	RW	
Stored in EEPROM	Yes	
Default Value	-	
Value range	-	-
Map to PDO	Yes	

Description:

Detailed description in section 5.1.2 0x6061 Modes of operation display.

8.81 0x6063 Position actual value internal

Name	Position actual value internal	
Index	0x6063	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-2147483648	2147483647
Map to PDO	Yes	

Description

The actual value of the position measurement device is one of the two input values of the closed loop position control. The data unit is defined as increments. If necessary, the data unit must be transformed with the position factor defined in chapter 11 from user defined units to increments.

8.82 0x6064 Position actual value

Name	Position actual value
-------------	------------------------------

Index	0x6064	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	-2147483648	2147483647
Map to PDO	Yes	

Description

The actual value of the position measurement device is one of the two input values of the closed loop position control. The data unit is defined as increments. If necessary, the data unit must be transformed with the position factor defined in chapter 11 from user defined units to increments.

8.83 0x6065 Following error window

Name	Following error window	
Index	0x6065	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1000	
Value range	1	32767
Map to PDO	Yes	

Description

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

- a drive is blocked,
- unreachable profile velocity occurs, or
- at wrong closed loop coefficients.

If the value of the following error window is 232-1, the following control is switched off.

8.84 Position window

Name	Position window	
Index	0x6067	
Subindex	0x00	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	100	
Value range	1	32767
Map to PDO	Yes	

Description

The position window defines a symmetrical range of accepted positions relatively to the target position. If the actual value of the position encoder is within the position window, this target position is regarded as reached. As the user mostly prefers to specify the position window in his application in user defined units, the position factor of chapter 11 must be used to transform this value into increments. The target position has to be handled in the same manner as in the Trajectory Generator concerning limiting functions and transformation into internal machine units before it can be used with this function.

If the value of the position window is 232-1, the position window control is switched off.

8.85 0x6069 Velocity sensor actual value

Name	Velocity sensor actual value	
Index	0x6069	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-2147483648	2147483647
Map to PDO	Yes	

Description

The velocity sensor actual value describes the value read from a velocity encoder (if present) in increments (in the case of encoders) and in increments per second (in the case of tachometers and AD converters). This value is scaled to the format of the position encoder using the scaling factor velocity factor 2.

8.86 0x606C Velocity actual value

Name	Velocity actual value	
Index	0x606C	
Subindex	0x00	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-2147483648	2147483647
Map to PDO	Yes	

Description

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

8.87 0x6071 Target torque

Name	Target torque	
Index	0x6071	
Subindex	0x00	

Type	<i>INTEGER16</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>No</i>	
Default Value	<i>0</i>	
Value range	<i>-1000</i>	<i>1000</i>
Map to PDO	<i>Yes</i>	

Description

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

8.88 0x6075 Motor rated current

Name	Motor rated current	
Index	<i>0x6075</i>	
Subindex	<i>0x00</i>	
Type	<i>INTEGER32</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>No</i>	
Default Value	<i>59800</i>	
Value range	<i>-2147483648</i>	<i>2147483647</i>
Map to PDO	<i>Yes</i>	

Description

This value is taken from the motor name plate and is entered as multiples of milliamp. Depending on the motor and drive technology this current may be either DC, peak or rms (root-mean-square) current. All relative current data refers to this value.

8.89 0x6076 Motor rated torque

Name	Motor rated torque	
Index	<i>0x6076</i>	
Subindex	<i>0x00</i>	
Type	<i>INTEGER32</i>	
Access	<i>RW</i>	
Stored in EEPROM	<i>No</i>	
Default Value	<i>59800</i>	
Value range	<i>-2147483648</i>	<i>2147483647</i>
Map to PDO	<i>Yes</i>	

Description

This value is taken from the motor name plate and is entered as multiples of mNm. All relative torque data refer to this value. For linear motors, the object name is not changed, but the motor rated force value must be entered as multiples of mN.

8.90 0x6077 Torque actual value

Name	Torque actual value
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Index	0x6077	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	-	
Value range	-	-
Map to PDO	Yes	

Description

Not used.

8.91 0x6078 Motor current Actual Values

Name	Motor current Actual Values	
Index	0x6078	
Number of entries	2	

Name	Number of entries	
Index	0x6078	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Current torque actual value	
Index	0x6078	
Subindex	0x01	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	Yes	

Description

The torque actual value is actual value of torque current. Value in 1/1000 motor current.

Name	Current torque actual value mA	
Index	0x6078	
Subindex	0x02	
Type	INTEGER32	
Access	RO	
Stored in EEPROM	-	
Default Value	0	
Value range	-	-
Map to PDO	Yes	

Description

The torque actual value mA is actual value of torque current in mA.

8.92 0x6079 DC link actual voltage

Name	DC link actual voltage	
Index	0x6079	
Subindex	0x00	
Type	INTEGER16	
Access	RO	
Stored in EEPROM	No	
Default Value	0	
Value range	-	-
Map to PDO	Yes	

Description

Object is read only and it's internally measured and displayed in 1/10 V.

8.93 0x607A Target position

Name	Target position	
Index	0x607a	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	No	
Default Value	0	
Value range	-2147483648	2147483647
Map to PDO	Yes	

Description

The target position is the position that the drive should move to in position profile mode using the current settings of motion control parameters such as velocity, acceleration, deceleration, motion profile type etc. The target position is given in user defined position units. It is converted to position increments using the position factor (see chapter 11). The target position will be interpreted as absolute or relative depending on the 'abs / rel' flag in the controlword.

8.94 0x607E Polarity

Name	Polarity	
Index	0x607E	
Subindex	0x00	
Type	UNSIGNED8	
Access	RW	
Stored in EEPROM	No	
Default Value	1	
Value range	0	1
Map to PDO	No	

Description

Demand and return value of selected modes of operation will be inverted depending of the value of the polarity flag.

Data description

Value	Description
0	Not inverted
1	inverted

8.95 0x6093 Position factor

Name	Position factor	
Index	0x6093	
Number of entries	-	

Name	Number of entries	
Index	0x6093	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Position factor numerator	
Index	0x6093	
Subindex	0x01	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	60	
Value range	0	2147483647
Map to PDO	Yes	

Name	Position factor divisor	
Index	0x6093	
Subindex	0x02	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	4096	
Value range	0	2147483647
Map to PDO	Yes	

Description

The position encoder factor converts the desired position (in position units) into the internal format (in increments).

$$PositionActualValue = \frac{PositionFactorNumerator \bullet PositionActualValue}{PositionFactorDevisor}$$

8.96 0x6094 Velocity Encoder factor

Name	Velocity Encoder factor
Index	0x6094
Number of entries	-

Name	Number of entries	
Index	0x6094	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Velocity Encoder factor numerator	
Index	0x6094	
Subindex	0x01	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	60	
Value range	0	2147483647
Map to PDO	Yes	

Name	Velocity Encoder factor divisor	
Index	0x6094	
Subindex	0x02	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	4096	
Value range	0	2147483647
Map to PDO	Yes	

Description

The velocity encoder factor converts the desired velocity (in velocity units) into the internal format (in increments).

$$VelocityActualValue = \frac{VelocityFactorNumerator \bullet VelocityActualValue}{VelocityFactorDevisor}$$

8.97 0x60f6 Current control parameter

Name	Current control parameter	
Index	0x60f6	
Number of entries	-	

Name	Number of entries	
Index	0x60f6	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Current control parameter set P-gain	
Index	0x60f6	
Subindex	0x01	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1000	
Value range	1	32767
Map to PDO	Yes	

Description:

Gain for P part of current PI regulator in units 1/1000.

Name	Current control parameter set I-gain	
Index	0x60f6	
Subindex	0x01	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	200	
Value range	1	32767
Map to PDO	Yes	

Description

Gain for I part of current PI regulator in units 1/second.

8.98 0x60f9 Velocity control parameter

Name	Velocity control parameter	
Index	0x60f6	
Number of entries	-	

Name	Number of entries	
Index	0x60f6	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	
Default Value	2	
Value range	0	255
Map to PDO	No	

Name	Velocity control P-gain	
Index	0x60f6	
Subindex	0x01	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	5000	
Value range	1	32767
Map to PDO	Yes	

Description:

Gain for P part of velocity PI regulator in units 1/1000.

Name	Velocity control I-gain	
Index	0x60f6	
Subindex	0x01	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	100	
Value range	1	32767
Map to PDO	Yes	

Description

Gain for I part of velocity PI regulator in units 1/second.

8.99 0x60fb Position control parameter set

Name	Position control parameter set	
Index	0x60fb	
Number of entries	-	

Name	Number of entries	
Index	0x60fb	
Subindex	0x00	
Type	UNSIGNED8	
Access	RO	
Stored in EEPROM	-	

Default Value	4	
Value range	0	255
Map to PDO	No	

Name	Position control parameter set P-gain	
Index	0x60fb	
Subindex	0x01	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	1000	
Value range	1	32767
Map to PDO	Yes	

Description:

Gain for P part of position PI regulator in units 1/1000

Name	Position control parameter set I-gain	
Index	0x60fb	
Subindex	0x02	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	1	32767
Map to PDO	Yes	

Description:

Gain for I part of velocity PI regulator in units 1/second.

Name	Position control parameter set D-gain	
Index	0x60fb	
Subindex	0x03	
Type	INTEGER16	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	1	32767
Map to PDO	Yes	

8.1000x60ff Target Velocity

Name	Target Velocity	
Index	0x60ff	
Subindex	0x00	
Type	INTEGER32	
Access	RW	
Stored in EEPROM	Yes	
Default Value	0	
Value range	10000	10000

Map to PDO	Yes
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Description

The target velocity is the input for the trajectory generator and the value is given in velocity units.

8.101 0x6504 Drive manufacturer

Name	Drive manufacturer	
Index	0x60ff	
Subindex	0x00	
Type	VISIBLE_STRING	
Access	RO	
Stored in EEPROM	No	
Default Value	EMSISO	
Value range	0	0
Map to PDO	Yes	

Description

The drive manufacturer's name.