Technical Manual N6

Fieldbus: PROFINET / PROFIdrive

For use with the following variants:

N6-1-10-1, N6-1-10-1-S, N6-2-10-1, N6-2-10-1-S

Valid with firmware version FIR-v2542
and since hardware version 0

Technical Manual Version: 1.0.2

Contents

1 Introduction....10
1.1 Product documentation....10
1.2 Version information....10
1.3 Copyright, marking and contact....10
1.4 Intended use....11
1.5 Target group and qualification....11
1.6 Warranty and disclaimer....11
1.7 Other applicable regulations....11
1.8 EU directives for product safety....11
1.9 Used icons....12
1.10 Emphasis in the text....12
1.11 Numerical values....13
1.12 Bits....13
1.13 Counting direction (arrows)....13

2 Safety and warning notices....14

3 Technical details and pin assignment....15
3.1 Environmental conditions....15
3.2 Dimensioned drawings and installation options....16
3.3 Electrical properties and technical data....16
3.4 Overtemperature protection....17
3.5 LED signaling....17
3.5.1 Power LED....17
3.5.2 PROFINET LEDs....18
3.6 Pin assignment....19
3.6.1 X1 – motor connection....19
3.6.2 X2 — voltage supply....19
3.6.3 X3 - STO (*Safe Torque Off*)....21
3.6.4 X4 – inputs and outputs....22
3.6.5 X5 – SSI encoder....23
3.6.6 X6 – incremental encoder/Hall sensors....24
3.6.7 X7 – PROFINET IN....25
3.6.8 X8 – PROFINET OUT....25
3.6.9 Micro USB....26

4 PROFINET....27
4.1 Telegrams....27

5 PROFIdrive....33
5.1 PROFIdrive operating modes....33
5.1.1 Positioning....33
5.1.2 Speed Control....37
5.1.3 Torque....39
5.2 PROFIdrive Object Dictionary....41
5.2.1 Overview....41
5.2.2 Data types....42
715 Selection Switch For DO IO Data (subindex) In The Setpoint Telegram....42

716 Selection Switch For DO IO Data (subindex) In The Actual Value Telegram..... 45
750 Control Word 2 (STW2)..... 49
751 Status Word 2 (ZSW2)..... 49
752 Automatic Telegram Assignment..... 50
752 Automatic Telegram Assignment..... 50
800 Traverse Record Target Position..... 51
801 Traverse Record Position Velocity..... 57
802 Traversing Record Position Acceleration..... 64
803 Traversing Record Position Deceleration..... 71
808 Traverse Record Command Set Selection..... 77
809 Traverse Record Current Command Set..... 78
810 Target Position..... 78
811 Position Velocity..... 79
812 Position Acceleration..... 79
813 Position Deceleration..... 80
819 Position Mode..... 80
820 Target Velocity NSOLL_A..... 81
821 Actual Velocity NIST_A..... 81
822 Target Velocity NSOLL_B..... 82
823 Actual Velocity NIST_B..... 82
824 Homing Speed..... 83
825 Homing Acceleration..... 84
830 Speed Error Tolerance Range..... 84
831 Speed Error Tolerance Time..... 85
841 Torque Max Velocity..... 85
872 Speed Control Acceleration..... 86
873 Speed Control Deceleration..... 86
882 Begin Acceleration Jerk..... 87
883 Begin Deceleration Jerk..... 87
884 End Acceleration Jerk..... 88
885 End Deceleration Jerk..... 88
898 Acceleration Reference Value..... 89
899 Jerk Reference Value..... 89
915 Selection Switch For DO IO Data In The Setpoint Telegram..... 90
916 Selection Switch For DO IO Data In The Actual Value Telegram..... 93
922 Telegram Selection..... 97
923 List Of All Parameters For Signals..... 97
930 Operating Mode..... 105
944 Fault Message Counter..... 106
945 Fault Code..... 106
947 Fault Number..... 119
952 Fault Situation Counter..... 132
964 Drive Unit Identification..... 133
965 Profile Identification Number..... 134
967 Control Word 1 (STW1)..... 135
968 Status Word 1 (ZSW1)..... 135
970 Load Parameter Set..... 136
971 Transfer Into A Nonvolatile Memory..... 136
972 Drive Reset..... 137
974 Base Mode Parameter Access Identification..... 137
975 Drive Object Identification..... 138
980 Number List Of Defined Parameter..... 140
60000 Velocity Reference Value..... 141
61000 Name Of Station..... 141
61001 Ip Of Station..... 142
61003 Default Gateway Of Station..... 142
61004 Subnet Mask Of Station..... 142

6 Commissioning....144
6.1 PROFINET settings....145
6.2 First commissioning in the *TIA Portal*....145
6.3 Configuration via USB....150
6.3.1 General....150
6.3.2 USB connection....151
6.3.3 Configuration file....152
6.3.4 NanoJ program....154
6.4 Setting the motor data....155
6.5 Connecting the motor....156
6.6 Auto setup....156
6.6.1 Parameter determination....157
6.6.2 Execution....157
6.6.3 Parameter memory....159
6.7 Configuring the sensors....159

7 General concepts....162
7.1 Control modes....162
7.1.1 General....162
7.1.2 Open-Loop....163
7.1.3 Closed-Loop....164
7.2 Cycle times....171

8 Special functions....172
8.1 Digital inputs and outputs....172
8.1.1 Digital inputs....172
8.1.2 Digital outputs....175
8.1.3 Pulse generator....178
8.2 Analog inputs....178
8.2.1 Object entries....179
8.2.2 Scale analog value....179
8.3 Automatic brake control....179
8.3.1 Description....179
8.3.2 Activation and connection....179
8.3.3 Brake control....179
8.3.4 Brake PWM....180
8.4 External brake chopper (ballast)....181
8.4.1 Control of the ballast resistor....181
8.4.2 Activating the brake chopper....181
8.4.3 Ballast monitoring....181
8.5 I^2t Motor overload protection....182
8.5.1 Description....182
8.5.2 Object entries....183
8.5.3 Activation....183
8.5.4 Function of I^2t....183
8.6 Saving objects....184
8.6.1 General....184
8.6.2 Category: Communication....184
8.6.3 Category: Application....184
8.6.4 Category: User....187
8.6.5 Category: Motor....187
8.6.6 Category: Sensor....187
8.6.7 Category: Ethernet....187
8.6.8 Starting the save process....188
8.6.9 Discarding the saved data....188

8.6.10 Verifying the configuration....189
8.7 Touch Probe (capture)....189

9 Programming with NanoJ....190
9.1 NanoJ program....190
9.2 Mapping in the NanoJ program....193
9.3 NanoJ functions in the NanoJ program....195
9.4 Restrictions and possible problems....196

10 *CiA 402* operating modes and state machine....197
10.1 CiA 402 Power State Machine....197
10.1.1 State machine....197
10.1.2 Behavior upon exiting the *Operation enabled* state....198
10.2 User-defined units....201
10.2.1 Units....202
10.2.2 Encoder resolution....203
10.2.3 Gear ratio....203
10.2.4 Feed constant....204
10.2.5 Calculation formulas for user units....204
10.3 Profile Position....206
10.3.1 Overview....206
10.3.2 Setting travel commands....207
10.3.3 Loss of accuracy for relative movements....211
10.3.4 Boundary conditions for a positioning move....212
10.3.5 Jerk-limited mode and non-jerk-limited mode....213
10.4 Velocity....214
10.4.1 Description....214
10.4.2 Activation....214
10.4.3 Controlword....214
10.4.4 Statusword....214
10.4.5 Object entries....214
10.5 Profile Velocity....215
10.5.1 Description....215
10.5.2 Activation....215
10.5.3 Controlword....215
10.5.4 Statusword....215
10.5.5 Object entries....216
10.6 Profile Torque....218
10.6.1 Description....218
10.6.2 Activation....218
10.6.3 Controlword....218
10.6.4 Statusword....218
10.6.5 Object entries....219
10.7 Homing....220
10.7.1 Overview....220
10.7.2 Homing method....222
10.8 Clock-direction mode....227
10.8.1 Description....227
10.8.2 Activation....227
10.8.3 General....227
10.8.4 Statusword....228
10.8.5 Subtypes of the clock-direction mode....228
10.9 Auto setup....229
10.9.1 Description....229
10.9.2 Activation....229
10.9.3 Controlword....229
10.9.4 Statusword....230

10.10 Limitation of the range of motion....230
10.10.1 Behavior upon reaching the limit switch....230
10.10.2 Software limit switches....231

11 Description of the *CiA 402* object dictionary....232

11.1 Overview....232
11.2 Structure of the object description....232
11.3 Object description....232
11.4 Value description....233
11.5 Description....234
1000h Device Type....235
1001h Error Register....236
1003h Pre-defined Error Field....237
1008h Manufacturer Device Name....241
1009h Manufacturer Hardware Version....242
100Ah Manufacturer Software Version....242
1010h Store Parameters....243
1011h Restore Default Parameters....246
1018h Identity Object....250
1020h Verify Configuration....251
1F50h Program Data....252
1F51h Program Control....253
1F57h Program Status....254
200Fh IEEE 802 MAC Address....255
2010h IP-Configuration....256
2011h Static-IPv4-Address....257
2012h Static-IPv4-Subnet-Mask....258
2013h Static-IPv4-Gateway-Address....259
2014h Current-IPv4-Address....260
2015h Current-IPv4-Subnet-Mask....261
2016h Current-IPv4-Gateway-Address....262
2030h Pole Pair Count....262
2034h Upper Voltage Warning Level....263
2035h Lower Voltage Warning Level....263
2038h Brake Controller Timing....264
2039h Motor Currents....266
203Dh Torque Window....268
203Eh Torque Window Time Out....268
203Fh Max Slippage Time Out....269
2057h Clock Direction Multiplier....269
2058h Clock Direction Divider....270
205Bh Clock Direction Or Clockwise/Counter-Clockwise Mode....270
205Ch Pulse Generator Configuration....271
2101h Fieldbus Module Availability....273
2102h Fieldbus Module Control....274
2103h Fieldbus Module Status....275
2290h PDI Control....277
2291h PDI Input....277
2292h PDI Output....279
2300h NanoJ Control....280
2301h NanoJ Status....281
2302h NanoJ Error Code....282
2303h NanoJ Metadata....283
230Eh Timer....285
230Fh Uptime Seconds....286
2310h NanoJ Input Data Selection....286
2320h NanoJ Output Data Selection....288
2330h NanoJ In/output Data Selection....289

2400h NanoJ Inputs....290
2500h NanoJ Outputs....291
2701h Customer Storage Area....292
2800h Bootloader And Reboot Settings....293
306Ch Velocity Actual Internal Value....294
3202h Motor Drive Submode Select....295
3203h Feedback Selection....296
3204h Feedback Mapping....298
3205h Feedback Use....299
320Dh Moment Of Inertia....301
3211h Motor Drive Set Point....302
3219h Current Configuration....304
321Ah Current Controller Parameters....305
321Bh Velocity Controller Parameters....307
321Ch Position Controller Parameters....308
321Dh Feedforward....309
321Eh Voltage Limit....311
3220h Analog Input Digits....311
323Ah User Pin Settings....312
3241h Digital Input Position Capture....314
3242h Digital Input Routing....317
324Ah Inputs....324
3250h Digital Outputs Control....325
3252h Digital Output Routing....326
325Ah Outputs....327
3260h Pwm Output 0....328
3261h Pwm Output 1....330
3262h Pwm Output 2....331
3320h Analog Input Values....332
3321h Analog Input Offsets....333
3322h Analog Input Numerators....334
3323h Analog Input Denominators....335
3380h Feedback Sensorless....336
3390h Feedback Hall....337
33A0h Feedback Incremental A/B/I 1....341
33B0h Feedback SSI 1....342
3505h Additional PROFIdrive Mapping RX....347
3605h Additional PROFIdrive Mapping TX....349
3700h Deviation Error Option Code....351
3701h Limit Switch Error Option Code....352
4014h Operating Conditions....353
4015h Special Drive Modes....355
4021h Ballast Configuration....356
4040h Drive Serial Number....358
4041h Device Id....359
4042h Bootloader Infos....359
603Fh Error Code....360
6040h Controlword....361
6041h Statusword....362
605Ah Quick Stop Option Code....363
605Bh Shutdown Option Code....364
605Ch Disable Operation Option Code....365
605Dh Halt Option Code....366
605Eh Fault Reaction Option Code....366
6060h Modes Of Operation....367
6061h Modes Of Operation Display....368
6062h Position Demand Value....368
6063h Position Actual Internal Value....369
6064h Position Actual Value....369

6065h Following Error Window....370
6066h Following Error Time Out....370
6067h Position Window....371
6068h Position Window Time....371
606Bh Velocity Demand Value....372
606Ch Velocity Actual Value....372
606Dh Velocity Window....373
606Eh Velocity Window Time....373
606Fh Velocity Threshold....374
6070h Velocity Threshold Time....374
6071h Target Torque....375
6072h Max Torque....375
6073h Max Current....376
6074h Torque Demand....377
6075h Motor Rated Current....377
6077h Torque Actual Value....378
607Ah Target Position....378
607Bh Position Range Limit....379
607Ch Home Offset....380
607Dh Software Position Limit....380
607Eh Polarity....381
607Fh Max Profile Velocity....382
6080h Max Motor Speed....383
6081h Profile Velocity....384
6082h End Velocity....384
6083h Profile Acceleration....384
6084h Profile Deceleration....385
6085h Quick Stop Deceleration....385
6086h Motion Profile Type....386
6087h Torque Slope....386
6091h Gear Ratio....387
6092h Feed Constant....388
6096h Velocity Factor....389
6097h Acceleration Factor....390
6098h Homing Method....391
6099h Homing Speed....391
609Ah Homing Acceleration....393
60A2h Jerk Factor....393
60A4h Profile Jerk....394
60A8h SI Unit Position....396
60A9h SI Unit Velocity....397
60B0h Position Offset....397
60B1h Velocity Offset....398
60B2h Torque Offset....398
60C1h Interpolation Data Record....399
60C2h Interpolation Time Period....400
60C4h Interpolation Data Configuration....401
60C5h Max Acceleration....403
60C6h Max Deceleration....403
60E4h Additional Position Actual Value....404
60E5h Additional Velocity Actual Value....405
60E6h Additional Position Encoder Resolution - Encoder Increments....406
60EBh Additional Position Encoder Resolution - Motor Revolutions....407
60F1h Additional Encoder Inversion....408
60F2h Position Option Code....409
60F4h Following Error Actual Value....411
60F8h Max Slippage....411
60FAh Control Effort....412
60FCh Position Demand Internal Value....412

60FDh Digital Inputs..... 413
60FEh Digital Outputs..... 414
60FFh Target Velocity..... 415
6502h Supported Drive Modes..... 415
6503h Drive Catalogue Number..... 416
6505h Http Drive Catalogue Address..... 417

12 Copyrights..... 418
12.1 Introduction..... 418
12.2 AES..... 418
12.3 MD5..... 418
12.4 DHCP..... 419
12.5 CMSIS DSP Software Library..... 419
12.6 Protothreads..... 419
12.7 lwIP..... 420
12.8 littlefs..... 420

1 Introduction

The *N6* is a controller for the *open-loop* or *closed loop* operation of stepper motors and the *closed loop* operation of BLDC motors.

This manual describes the functions of the controller and the available operating modes. It also shows how you can address and program the controller via the communication interface.

You can find further information on the product on us.nanotec.com.

1.1 Product documentation

All product documentation is available on the respective product page at us.nanotec.com.

Document	Content
Technical manual (this document)	Installation, commissioning, parameterization/programming, description of the functions of the motor controller
Function description STO	Description of the integrated *STO* safety function for the product variants that include this function (N6-...-**S**)

You can read out the hardware version from object 1009_h. You can find details in the technical manual of your variant.

1.2 Version information

Manual version	Date	Changes	Firmware version
1.0.0	10/2025	Edition	v2539
1.0.1	01/2026	New Firmware version: minor adjustments and corrections. Homing: Method 37 replaces 35. Notice regarding methods −17 and −18 added.	FIR-v2542
1.0.2	05/2026	Correction: Voltaga of the brake output corresponds to the UB_Logic and is not switchable. Corrections / additions in the description and example for the SSI encoder setup in 33B0h Feedback SSI 1.	FIR-v2542

1.3 Copyright, marking and contact

© 2013 – 2026 Nanotec Electronic GmbH & Co. KG. All rights reserved.

CE

Nanotec Electronic GmbH & Co. KG

Kapellenstraße 6

85622 Feldkirchen (Germany)

Germany

Phone: +49 89 900 686-0

Fax: +49 (89) 900 686-50

us.nanotec.com

Microsoft® Windows® 98/NT/ME/2000/XP/7/10/11 and PowerShell® are registered trademarks of the Microsoft Corporation.

1.4 Intended use

The *N6* serves to control stepper motors and BLDC motors and is used as a component in drive systems in a wide range of industrial applications.

Use the product as intended within the limits defined in the technical data (in particular, see Permissible operating voltage) and the approved Environmental conditions.

With the exception of the *N6-...-S* product variants, which support the *STO* safety function (Safe Torque Off)), this Nanotec product may under no circumstances be integrated as a safety component in a product or system.

All products containing a component manufactured by Nanotec must, upon delivery to the end user, be provided with corresponding warning notices including instructions for safe use and safe operation. All warning notices provided by Nanotec must be passed on directly to the end user.

1.5 Target group and qualification

The product and this documentation are directed towards technically trained specialists staff such as:

- Development engineers
- Plant engineers
- Installers/service personnel
- Application engineers

Only specialists may install, program and commission the product. Specialist staff are persons who

- have appropriate training and experience in working with motors and their controller,
- are familiar with and understand the content of this technical manual,
- know the applicable regulations.

1.6 Warranty and disclaimer

Nanotec shall not be liable for damage and malfunctions attributable to installation errors, failure to observe this document or improper repair. The plant engineer, operating company and user shall be responsible for the selection, operation and use of our products. Nanotec shall not take responsibility for integration of the product in the end system. The general terms and conditions listed at www.nanotec.de shall apply.
Comment: Modifications/changes to the product as well as opening the product are prohibited.

1.7 Other applicable regulations

In addition to this technical manual, the following regulations are to be observed:

- Accident-prevention regulations
- Local regulations on occupational safety

1.8 EU directives for product safety

The following EU directives were observed:

- RoHS directive (2011/65/EU, 2015/863/EU)

1.9 Used icons

All notices are in the same format. The degree of the hazard is divided into the following classes.

CAUTION!

The CAUTION notice indicates a possibly dangerous situation.

Failure to observe the notice **may** result in moderately severe injuries.

► Describes how you can avoid the dangerous situation.

NOTICE

Indicates a possible incorrect operation of the product.

Failure to observe the notice may result in damage to this or other products.

► Describes how you can avoid the incorrect operation.

TIP

Shows a tip for the application or task.

STO-specific notices

The following points apply only to the products with the STO (*Safe Torque Off*) safety function.

CAUTION

The CAUTION note with the STO icon indicates a possibly dangerous situation that can arise from the loss of the safety function.

Failure to observe the notice **may** result in moderately severe injuries.

► Describes how you can avoid the dangerous situation.

Note

The note with the STO icon indicates a possible incorrect operation of the product with STO function.

Failure to observe the notice may result in damage to this or other products.

► Describes how you can avoid the incorrect operation.

1.10 Emphasis in the text

The following conventions are used in the document:

Underlined text indicates cross references and hyperlinks:

- The following bits in object 6041_h (statusword) have a special function:
- A list of available system calls can be found in chapter NanoJ functions in the NanoJ program.

Text set in *italics* marks named objects:

- Read the *installation manual*.

- Use the *Plug & Drive Studio* software to perform the auto setup.
- For software: You can find the corresponding information in the *Operation* tab.
- For hardware: Use the *ON/OFF* switch to switch the device on.

A text set in `Courier` marks a code section or programming command:

- The line with the `od_write(0x6040, 0x00, 5 );` command has no effect.
- The NMT message is structured as follows: `000 | 81 2A`

A text in "quotation marks" marks user input:

- Start the NanoJ program by writing object 2300_h, bit 0 = "1".
- If a holding torque is already needed in this state, the value "1" must be written in 3212_h:01_h.

1.11 Numerical values

Numerical values are generally specified in decimal notation. The use of hexadecimal notation is indicated by a subscript *h* at the end of the number.

The objects in the object dictionary are written with index and subindex as follows: `<Index>:<Subindex>`

Both the index as well as the subindex are specified in hexadecimal notation. If no subindex is listed, the subindex is 00_h.

Example: Subindex 5 of object 1003_h is addressed with $1003_h:05_h$, subindex 00 of object 6040_h with 6040_h.

1.12 Bits

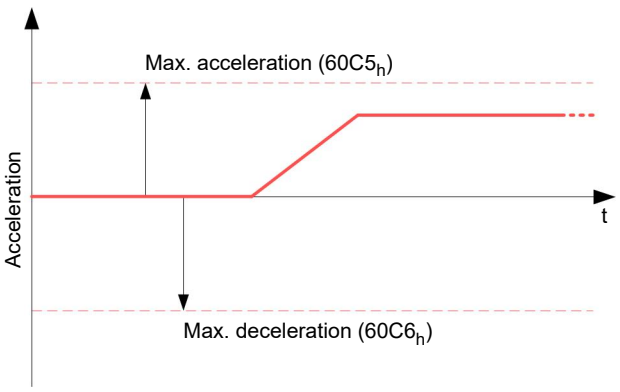
The numbering of individual bits in an object always begins with the LSB (bit number 0). See the following figure, which uses data type *UNSIGNED8* as an example.

	MSB							LSB
Bit Nummer	7	6	5	4	3	2	1	0
Bits	0	1	0	1	0	1	0	1

$\triangleq 55_{hex} \triangleq 85_{dec}$

1.13 Counting direction (arrows)

In figures, the counting direction is always in the direction of an arrow. Objects $60C5_h$ and $60C6_h$ depicted as examples in the following figure are both specified as positive.



2 Safety and warning notices

CAUTION

The loss of the safety function may lead to injuries!

► Observe the conditions for use for the STO function and for the product, as described in the document *Function description STO*

► Do not bypass the STO function.

► Do not use the STO function until all protective measures are set up and the validation of the machine/system is concluded after commissioning.

CAUTION

The loss of the safety function may lead to injuries!

If the supply voltage exceeds 60 V, the STO function cannot be ensured.

► For the power supply of the product variants with STO function, use only PELV circuits acc. to IEC 60204-1 that permit an absolute maximum voltage of 60 V (even in case of an error).

► If batteries are used, observe a maximum rated voltage of 48 V DC (with a tolerance of +20%), compliant with DVC A or B as defined in IEC 61800-5-1.

CAUTION

The loss of the safety function may lead to injuries!

Excessively high temperature can damage the electronics of the controller and of the STO. This may result in loss of the STO function.

► Observe the approved environmental conditions and the permissible power values.

► Install the product so that clean and dry cooling air is available for cooling and that this air can circulate around the product.

NOTICE

Damage to the controller!

Changing the wiring during operation may damage the controller.

► Only change the wiring in a de-energized state. After switching off, wait until the capacitors have discharged.

NOTICE

Damage to the controller due to excitation voltage of the motor!

Voltage peaks during operation may damage the controller.

► Install suitable circuits (e. g., charging capacitor) that reduce voltage peaks.

NOTICE

Damage to the electronics through improper handling of ESD-sensitive components!

The device contains components that are sensitive to electrostatic discharge. Improper handling can damage the device.

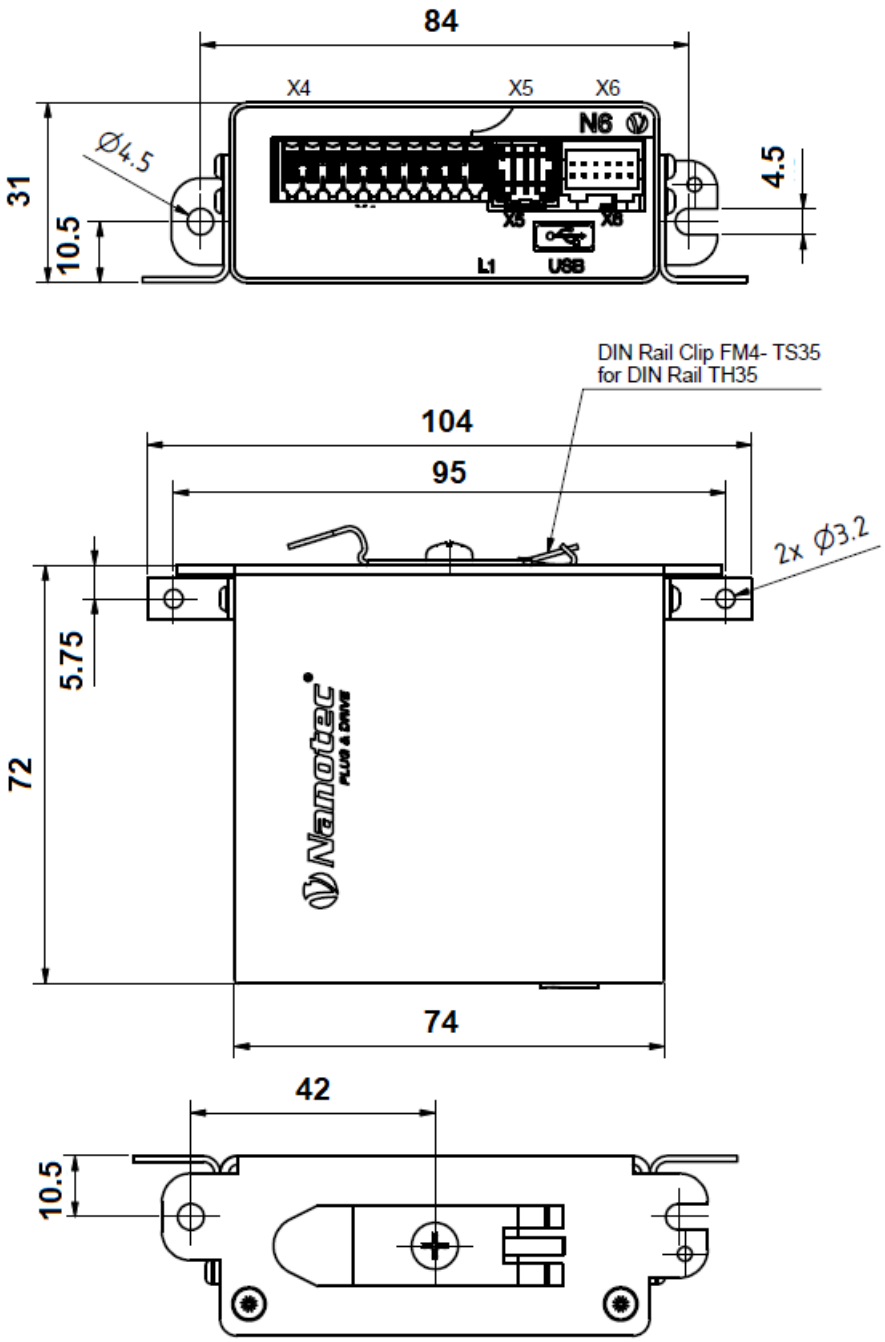
► Observe the basic principles of ESD protection when handling the device.

3 Technical details and pin assignment

3.1 Environmental conditions

Environmental condition	Value
Protection class	IP20
Degree of contamination	2
Ambient temperature (operation)	-10 … +40°C
Ambient temperature (storage and transport)	-20 … +85°C
Relative humidity (operation), non-condensing	0 … 95 %
Relative humidity (storage and transport), non-condensing	0 … 90 %
Absolute humidity (storage and transport), non-condensing	30 g/m^3
Max. altitude of site above *sea level*	2000 m (drop in performance above 1000 m: -1%/100 m)
Max. altitude of site above *sea level* (storage and transport)	3000 m

3.2 Dimensioned drawings and installation options



You can secure the controller by its side tabs to a flat mounting surface using screws or mount it on a TH35 DIN rail in your switch cabinet using the supplied DIN rail clip.

3.3 Electrical properties and technical data

Property	Description / value
Operating voltage	12 V -5%…57.6 V DC
Rated current	6 A_{rms}
Peak current	N6-1-… (*low current*): 6 A_{rms}

Property	Description / value
	N6-2-… (*high current*): 18 A_{rms} for 5 seconds
Commutation	Stepper motor – open loop, stepper motor – closed loop with encoder, BLDC motor – closed loop with Hall sensor, and BLDC motor – closed loop with encoder
Operating modes	*Positioning*, *Torque*, *Homing Mode*, *CiA 402* operating modes
Set value setting / programming	*PROFINET*, *clock-direction*, *analog*, *NanoJ program*
Interfaces	PROFINET, USB
Inputs	■ 6 inputs, 5 V/24 V (=UB_Logic), switchable by means of software, factory setting: 5 V ■ 2 analog inputs 0 to +24 V, 12-bit resolution
Outputs	3 outputs, 5 V/24 V (=UB_Logic), switchable by means of software, 100 mA
Brake connection	1 PWM output, max. 1.5 A, 20 kHz
Sensor inputs	1 incremental encoder (5 V, differential), 3 Hall sensors (5 V), 1 SSI encoder (10 V)
Protection circuit	Overvoltage and undervoltage protection Overtemperature protection (> 75° Celsius on the power board) Polarity reversal protection

3.4 Overtemperature protection

Above a temperature of approx. 75°C on the power board the power part of the controller switches off and the error bit is set (see objects 1001_h and 1003_h). After cooling down and confirming the error (see table for the controlword, "Fault reset"), the controller again functions normally.

NOTICE

Aside from the motor, the exact temperature behavior is also dependent on the flange connection and the heat transfer there as well as on the convection in the application. For this reason, Nanotec recommends always performing an endurance test in the actual environment for applications in which current level and ambient temperature pose a problem.

Make certain that heat dissipation through the mounting surface and passive cooling or active ventilation are possible to ensure that the maximum ambient temperature is not exceeded.

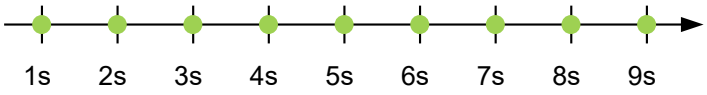
3.5 LED signaling

3.5.1 Power LED

The power LED indicates the current status.

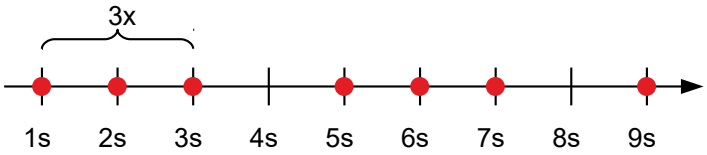
3.5.1.1 Normal operation

In normal operation, the green power LED L1 flashes briefly once per second.



3.5.1.2 Case of an error

If an error has occurred, the LED turns red and signals an error number.In the following figure, the error number 3 is signaled.



The following table shows the meaning of the error numbers.

Flash rate	Error
1	General
2	Voltage
3	Temperature
4	Overcurrent
5	Controller
6	Watchdog-Reset

NOTICE

For each error that occurs, a more precise error code is stored in object 1003_h.

TIP

You can switch off the operating LEDs via 3250_h:01_h.

3.5.2 PROFINET LEDs

3.5.2.1 L2 – Bus Failure (BF)

LED behavior	Status
Permanently on	No link status available
Flashing	Link OK, no active communication connection to PROFINET controller
Permanently off	No active communication with PROFINET controller

3.5.2.2 L3 – System Failure (SF)

LED behavior	Status
Permanently on	PROFINET diagnosis present
Permanently off	No PROFINET diagnosis

3.5.2.3 Link

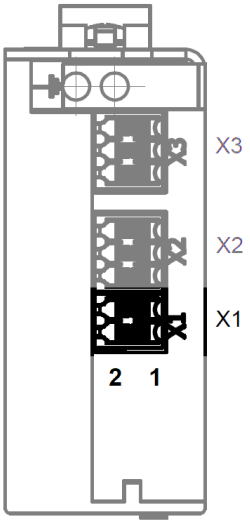
The *LINK* LEDs indicate the status of the physical Ethernet connection on PROFINET ports 1/IN (left) and 2/OUT (right).

3.6 Pin assignment

3.6.1 X1 – motor connection

- Type: Degson 15EDGRHD-3.5-04P-04
- Mating connector (included in the scope of delivery): Degson 15EDGKNHBM-3.5-04P (or equivalent)
- Conductor cross section, min.: 1 mm^2 (AWG 17)

Pins 1 and 2 are marked below.



Pin	Function (stepper motor)	Function (BLDC motor)	Note
1	A	U	
2	A\	V	
3	B	W	
4	B\	Not used	

NOTICE

Motor cables are to be routed through ferrites (74271222 from Würth or equivalent).

3.6.2 X2 — voltage supply

- Type: Degson 15EDGRHD-3.5-06P
- Mating connector (included in the scope of delivery): Degson 15EDGKNHB-3.5-06P (or equivalent)

NOTICE

Use 60° / 75° copper conductors only.

■ □ Conductor cross section, min.:

- 1 mm^2 (AWG 17) for main supply UB
- 0.8 mm^2 (AWG 18) for UB_Logic

3.6.2.1 Voltage source

The operating or supply voltage supplies a battery, a transformer with rectification and filtering, or a switching power supply.

CAUTION

STO

The loss of the safety function may lead to injuries!

If the supply voltage exceeds 60 V, the STO function cannot be ensured.

► For the power supply of the product variants with STO function, use only PELV circuits acc. to IEC 60204-1 that permit an absolute maximum voltage of 60 V (even in case of an error).

► If batteries are used, observe a maximum rated voltage of 48 V DC (with a tolerance of +20%), compliant with DVC A or B as defined in IEC 61800-5-1.

NOTICE

EMC: For a DC power supply line longer than 30 m or when using the motor on a DC bus, additional interference-suppression and protection measures are necessary.

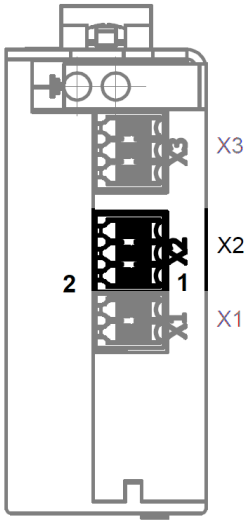
► It is recommended that an EMI filter (810911010 from Würth or equivalent) be inserted in the DC supply line(s) as close as possible to the controller/motor.

► Long data or supply lines are to be routed through ferrites.

► Motor cables are to be routed through ferrites (74271222 from Würth or equivalent).

3.6.2.2 Connections

Pins 1 and 2 are marked below.



Pin	Function	Note
1	GND_L	GND for the logic supply UB_Logic
2	+UB_Logic	Input voltage for the logic supply 12 V - 30 V DC,
3	Ballast-	Connection for optional external brake chopper, max. 6.5 A for 1 s, afterward switch off for min. 1 s
4	Ballast+	Connection for optional external brake chopper, max. 6.5 A for 1 s, afterward switch off for min. 1 s
5	GND_P	GND for the main supply UB
6	+UB	Input voltage for the main supply (power part), 12 V - 57.6 V DC

NOTICE

The logic supply powers the electronics, the sensors and the communication interface.

The windings of the motor are not supplied by the logic supply.

3.6.2.3 Permissible operating voltage

The maximum operating voltage is 57.6 V DC. If the input voltage of the controller exceeds the threshold value set in 2034_h, the motor is switched off and an error triggered. Above the response threshold set in 4021_h:02_h, the optional external ballast resistor is also switched on.

The minimum operating voltage is 12 V DC. If the input voltage of the controller falls below 10 V, the motor is switched off and an error triggered.

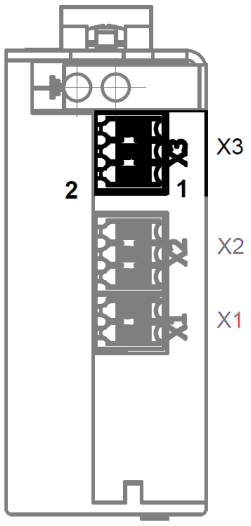
A charging capacitor of at least 4700 µF / 50 V (approx. 1000 µF per ampere rated current) must be connected to the supply voltage to avoid exceeding the permissible operating voltage (e.g., during braking). It is recommended that an EMI filter (810911010 from Würth or equivalent) be inserted in the DC supply line(s) as close as possible to the controller/motor.

3.6.3 X3 - STO (*Safe Torque Off*)

Connection for the STO signals. This connection and the corresponding integrated *STO* safety function are available only with the STO variants of the product (N6-x-x-x-**S**).

- Type: Degson 15EDGRHD-3.5-06P-04
- Mating connector (included in the scope of delivery): Degson 15EDGKNHBM-3.5 (or equivalent)

Pins 1 and 2 are marked below.



CAUTION

The loss of the safety function due to electromagnetic interference may lead to injuries!

External interference may affect and result in the loss of the safety function.

► Observe the maximum permissible cable length of 30 m for all STO signals. Longer cables reduce the interference immunity (EMC) and require additional interference-suppression and protection measures.

► Use shielded cables for the STO signals.

► Lay supply, signal and control cables physically separate from one another.

CAUTION

The loss of the safety function due to incorrect wiring may lead to injuries!

Incorrect wiring or the use of unsuitable external components may lead to the loss of the safety function. This could result in injuries.

► Only use components that correspond to the safety category of the application.

► Check the electrical installation (wiring, pin assignment) and validate the STO function prior to the initial commissioning and after every intervention in the wiring and each time components/equipment are replaced.

► Do not bypass the STO function. If the wiring for the initial commissioning does not correspond to the required safety category of the application, remove it immediately after the initial commissioning.

Pin	Function	Note
1	STOA_IN	STO channel A, PWM signal suppression Rated voltage 24 V DC, max. 60 V DC
2	STOA_RTN	GND connection for STO channel A
3	STO_FBH	STO feedback, high
4	STO_FBL	STO feedback, low
5	STOB_IN	STO channel B, gate driver switch Rated voltage 24 V DC, max. 60 V DC
6	STOB_RTN	GND connection for STO channel B

STO function

If the voltage at one of the two STO inputs (channel A and B) drops below 5 V, the STO function is triggered and the motor can no longer generate torque.

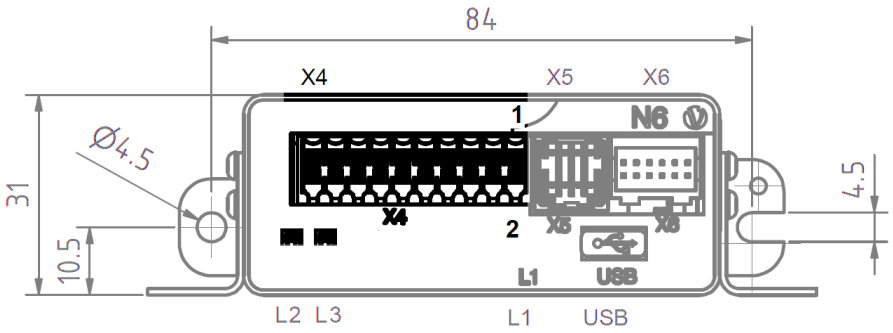
The feedback output is used for monitoring the status of the STO function. If the STO function is active, the contact between *STO_FBH* and *STO_FBL* closes.

A detailed description of the STO function can be found in the document *Function description STO*.

3.6.4 X4 – inputs and outputs

- Type: Degson 15EDGRHD-3.5-20P-14
- Mating connector (included in the scope of delivery): Degson 15EDGKNHB-3.5-20P (or equivalent)

Pins 1 and 2 are marked below.



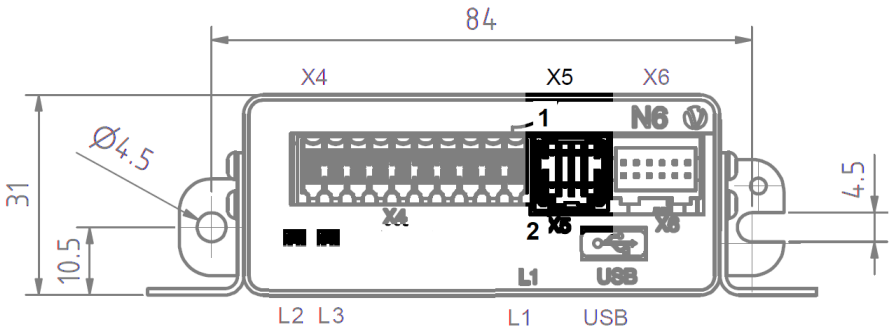
Pin	Function	Note
1	+10 V	+10 V DC, output voltage, max. 350 mA
2	GNDD	GND for digital inputs/outputs
3	+5 V	+5 V DC, output voltage, max. 350 mA
4	GNDD	GND for digital inputs/outputs
5	Output 1	5 V / 24 V digital output (UB_Logic), switchable by means of software with object 323A$_h$, max. 100 mA
6	Output 2	5 V / 24 V digital output (UB_Logic), switchable by means of software with object 323A$_h$, max. 100 mA
7	Output 3	5 V / 24 V digital output (UB_Logic), switchable by means of software with object 323A$_h$, max. 100 mA
8	GNDD	GND for digital inputs/outputs
9	Input 1	5 V / 24 V digital input, switchable by means of software with object 323A$_h$, direction input in clock-direction mode
10	Input 2	5 V / 24 V digital input, switchable by means of software with object 323A$_h$, clock input in clock-direction mode
11	Input 3	5 V / 24 V digital input, switchable by means of software with object 323A$_h$, max. 1 MHz
12	Input 4	5 V / 24 V digital input, switchable by means of software with object 323A$_h$, max. 1 MHz
13	Input 5	5 V to 24 V digital input, switchable by means of software with object 323A$_h$
14	Input 6	5 V to 24 V digital input, switchable by means of software with object 323A$_h$
15	GNDA	GND for analog input
16	Analog input 1	0 V…+24 V, 12-bit resolution
17	GNDA	GND for analog input
18	Analog input 2	0 V…+24 V, 12-bit resolution
19	Brake -	GND for brake
20	Brake +	PWM-controlled output, max. UB_Logic / 1500 mA, up to 20 KHz

3.6.5 X5 – SSI encoder

Connection for SSI encoder

- Type: Molex MicroClasp 55959-0830
- Mating connector (not included in scope of delivery): Molex 51353-0800 (or equivalent)

Pins 1 and 2 are marked below.



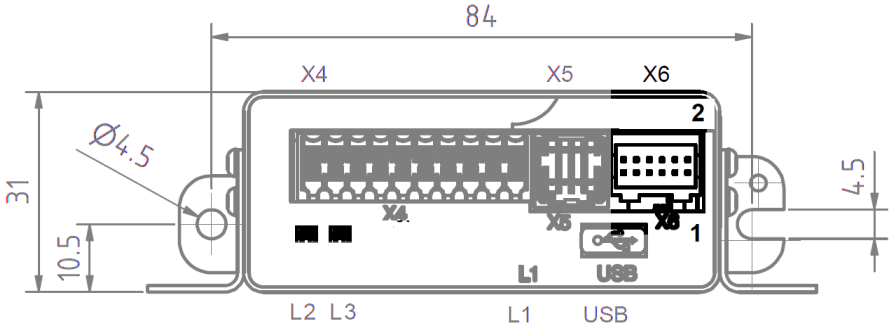
Pin	Function	Note
1	GND	
2	SHIELD	Connection for the shielding
3	n.c.	reserved
4	DATA B	
5	DATA A	
6	CLCK B	up to 3.8 MHz
7	CLCK A	up to 3.8 MHz
8	Vcc	+10…10.5 V DC±5%, output and supply voltage for SSI encoder, max. 350 mA

The clock signal and the binary-coded data are transferred as a differential signal (RS-422). A 120-ohm terminating resistor between *DATA A* and *DATA B* is provided internally. You must configure the encoder parameters in the object 33B0h Feedback SSI 1 according to the data sheet so that the encoder can be detected.

3.6.6 X6 – incremental encoder/Hall sensors

- Type: JST S12B-PADSS-1
- Mating connector (not included in scope of delivery):
  - Housing: JST PADP-12V-1-S (or equivalent)
  - Socket contacts: JST SPH-001T-P0.5L (or equivalent)
- Suitable Nanotec cables (not included in the scope of delivery):
  - ZK-PADP-12-500-S
  - ZK-M12-8-2M-2-PADP
  - ZK-M12-12-2M-2-PADP
  - ZK-NTO3-10-500-PADP / ZK-NTO3-10-1000-PADP
  - ZK-NOE-10-500-S-PADP
  - ZK-WEDL-500-S-PADP

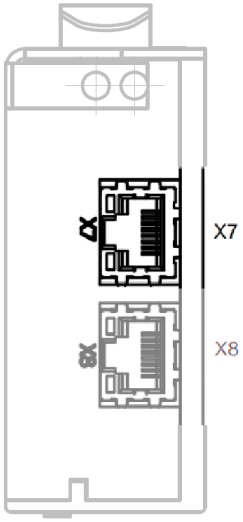
Pin 1 and pin 2 are marked in the figure.



Pin	Function	Note
1	GND	
2	Vcc	5 V DC, output and supply voltage for encoder / Hall sensor; max. 350 mA
3	A	5 V signal, max. 1 MHz
4	B	5 V signal, max. 1 MHz
5	A\	5 V signal, max. 1 MHz
6	B\	5 V signal, max. 1 MHz
7	I	5 V signal, max. 1 MHz
8	I\	5 V signal, max. 1 MHz
9	Hall 1	5 V signal
10	Hall 2	5 V signal
11	Hall 3	5 V signal
12	Shielding	Shielding

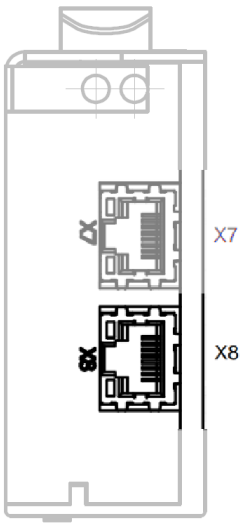
3.6.7 X7 – PROFINET IN

Type: RJ45 socket



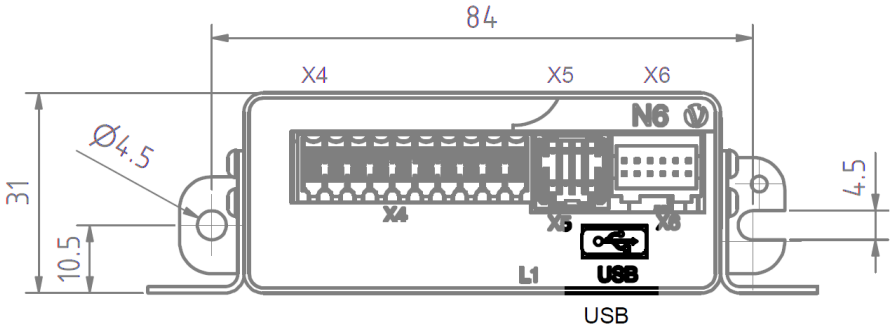
3.6.8 X8 – PROFINET OUT

Type: RJ45 socket



3.6.9 Micro USB

Micro USB connection for configuration/parameterization.



4 PROFINET

The product corresponds to the *Conformance Class* B and has an integrated 2-port switch. It supports the RT-class *RT_CLASS_1* with a recommended cycle time of 4 milliseconds [1] for the IO data. IRT (*Isochronous Real Time*) is not supported but the product may be integrated in an IRT-network.

The product supports the drive profile PROFIdrive of the *Profibus & Profinet International (PI)* according to the specification:

Profile Drive Technology - PROFIdrive Profile - Technical Specification for PROFIBUS and PROFINET - Version 4.2 – Date: October 2015

In PROFINET, the device is organized in various assembly groups and modules (slots, subslots) which are defined in the GSD file.

On this product, Slot 0 is equipped with the DAP (*Device Access Point*).

Slot 1 is euipped with the PROFIdrive module. This is organized in following sub-modules:

- Subslot 1: MAP (*Module Access Point*)
- Subslot 2 is reserved for the PROFIdrive Telegrams.
- Subslot 3 is reserved for the complementary telegram MT900.

4.1 Telegrams

Following telegrams with the corresponding PROFIdrive parameters are supported for cyclic exchange of process data.

You determine the source for the telegram selection with 752 Automatic Telegram Assignment:

- Value "0" The telegram is selected via the PROFINET project planning and the selected telegram is shown in 922 Telegram Selection.
- Value "1": You select the telegram via the PROFIdrive parameter 922 Telegram Selection.

Should you need more parameters in addition to the parameters in the selected telegram, set PNU 922 to "0", in order to be able to Add parameters.

Standard Telegram 1

This telegram contains setpoint and actual values (16 bit) for the operation mode Speed Control.

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
820	NSOLL_A	S16

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
821	NIST_A	S16

Standard Telegram 2

This telegram contains setpoint and actual values (32 bit) for the operation mode Speed Control.

[1] As long as no acyclic data is sent at the same time.

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
822	NSOLL_B_High	U16
822	NSOLL_B_Low	U16
750	STW2	U16

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
823	NIST_B_High	S16
823	NIST_B_Low	S16
751	ZSW2	U16

Standard Telegram 7

This telegram is used for the operation mode Positioning.

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
808	SATZANW	U16

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
809	AKTSATZ	U16

Standard Telegram 9

This telegram is used for the operation mode Positioning and conttains also the setpoints for the Manual Data Input (MDI).

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
808	SATZANW	U16
750	STW2	U16
810	MDI_TARPOS_High	U16
810	MDI_TARPOS_Low	U16
811	MDI_VELOCITY_High	U16
811	MDI_VELOCITY_Low	U16
812	MDI_ACC	U16

PNU	Signal Name	Data type
813	MDI_DEC	U16
819	MDI_MOD	U16

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
809	AKTSATZ	U16
751	ZSW2	U16
6064_h	XIST_A_High	U16
6064_h	XIST_A_Low	U16

Manufacturer Telegram 200

This telegram is used for the operation mode Torque.

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
6071_h	Target Torque	S16
750	STW2	U16
6087_h	TORQUE_SLOPE_High	U16
6087_h	TORQUE_SLOPE_Low	U16
841	MAX_TORQUE_VELOCITY_High	U16
841	MAX_TORQUE_VELOCITY_Low	U16

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
6077_h	TORQUE_ACTUAL_VALUE	S16
751	ZSW2	U16
6074_h	TORQUE_DEMAND	S16

Manufacturer Telegram 207

This telegram is used for the operation submode Homing.

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
808	SATZANW	U16
750	STW2	U16
6098_h	HM (Homing Mode)	S8

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
809	AKTSATZ	U16
751	ZSW2	U16

Manufacturer Telegram 209

This telegram is used for the operation mode Positioning.

Setpoint values:

PNU	Signal Name	Data type
967	STW1	U16
808	SATZANW	U16
750	STW2	U16
810	MDI_TARPOS_High	U16
810	MDI_TARPOS_Low	U16
811	MDI_VELOCITY_High	U16
811	MDI_VELOCITY_Low	U16
812	MDI_ACC	U16
813	MDI_DEC	U16
819	MDI_MOD	U16
6098_h	HM (Homing Method)	S8

Actual values:

PNU	Signal Name	Data type
968	ZSW1	U16
809	AKTSATZ	U16
751	ZSW2	U16
6064_h	XIST_A_High	U16
6064_h	XIST_A_Low	U16

Manufacturer Telegram 300

This telegram is used for the Nanotec *Plug&Drive interface*. You can find additional information in document *Function description Plug&Drive interface*.

NOTICE

In order to use the *Plug&Drive-Interface* you must reboot the controller and after the reboot set the mode in 930 Operating Mode to "0".

Setpoint values:

PNU	Signal Name	Data type
2291_h:1	PDI Set Value 1	S32
2291_h:2	PDI Set Value 2	S16
2291_h:3	PDI Set Value 3	S8
2291_h:4	PDI CMD	S8

Actual values:

PNU	Signal Name	Data type
2292_h:1	PDI Status	S16
$603F_h$:0	Error Code	U16
2292_h:2	PDI Return Val	S16

Manufacturer Telegram 900

This is a complementary telegram and can be additionaly used. It has no preset parameters.

You can map with *Plug&Drive Studio 3* a maximum of 8 additional 32 bit parameters respectively, in the objects 3505h Additional PROFIdrive Mapping RX and 3605h Additional PROFIdrive Mapping TX .

Setpoint values:

PNU	Signal Name	Data type
		U32
		U32
		U32
		U32
		U32
		U32
		U32
		U32

Actual values:

PNU	Signal Name	Data type
		U32
		U32
		U32
		U32
		U32
		U32
		U32
		U32

Add parameters

PROFIdrive allows only the mapping of parameters or of the first sub-index of a parameter. In order to be able to map parameters from the Nanotec object dictionary that are available in records or arrays, two arrays are provided by the firmware, where you can enter the proper (sub-)indices:

Mapping	Index	Subindex
Rx (Sollwerte)	PNU 915	PNU 715
Tx (Istwerte)	PNU 916	PNU 716

The value of these parameters correspond to the currently selected telegram, until you set 922 Telegram Selection to "0".

NOTICE

Enter the sub-index in PNU715 resp. PNU716 before the index in PNU915/PNU916, so that it is correctly checked, whether the parameter incl. sub-index can be mapped.

The first mapped parameters must remain STW1 and ZSW1 respectively

Example

The parameters 967 Control Word 1 (STW1) and 3203h Feedback Selection:02 shall be mapped.

1. Set 922 Telegram Selection to "0".
2. Set PNU 715:00 to the value "0".
3. Set PNU 915:00 to the value "967".
4. Set PNU 715:01 to the value "2".
5. Set PNU 915:01 to the value "3203_h".
6. Set PNU 971 to the value "1", to save the changes..
7. Reboot.

5 PROFIdrive

The product supports the drive profile PROFIdrive of the *Profibus & Profinet International (PI)* according to the specification:

Profile Drive Technology - PROFIdrive Profile - Technical Specification for PROFIBUS and PROFINET - Version 4.2 – Date: October 2015

The product is according to the specification a homogeneous P-Device (*peripheral device*) with the associated PROFIdrive API 14848 at the PROFINET bus. It consists of one PROFIdrive Drive Unit (one single axis).

The product supports thew following PROFIdrive application classes:

- Application classe 3 with an interface for positioning and *Closed Loop* support.

5.1 PROFIdrive operating modes

You set the operating mode in parameter 930. Following modes are supported:

- 0000_h (None): No mode is selected. To use the CiA modes or the PDI for example.
- 0001_h (Speed Control); In this mode you can use Telegrams 1 and 2.
- 0002_h (Positioning): In this mode you can use Telegrams 7, 9, 207 and 209.
- 8000_h (Autosetup): Foran autosetup you can use any teleram containing STW1 and ZSW1 and start the austosetup vie Bit 6 of STW1.
- 8004_h (Torque): In this mode you can use telegram 200.

5.1.1 Positioning

This mode is used to approach positions relative to the last target position or absolutely to the last reference position. During the movement, limit values for the speed, acceleration and deceleration and, if necessary, jerks are taken into account.

To activate the mode, set the parameter 930 Operating Mode to the value "2". In this mode you can use the Telegrams 7,9,207 or 209, the parameter is set automatically in this case.

The *Positioning* mode comprises the two submodes *Program* and *Manual Data Input* (MDI)

Program Mode

Motion programs are stored as 32 motion records in the program storage. A motion record consists of the new :

- target position (800 Traverse Record Target Position),
- velocity (801 Traverse Record Position Velocity),
- acceleration (802 Traversing Record Position Acceleration)
- and deceleration (803 Traversing Record Position Deceleration)

for the calculation of the path from the actual axis position to the new target position (relative).

The start of a motion program or the change to a new program while a program is still running, is done by selecting the first motion record of the new program via SATZANW (while SATZANW Bit15 = 0) and a positive edge of STW1 Bit6. The motion program is then executed by the program interpreter motion record for motion record as long as there is no stop or terminate condition in a motion record and the program is not terminated by STW1 Bit4 = 0. The motion of the axis may also be stopped intermediately by STW1 Bit5=0 (intermediate stop).

Manual Data Input

The Manual Data Input (MDI) enables the direct access to the motion command interface from the DO IO Data without using the program interpreter.

Changeover from the program execution to the MDI interface and vice versa is controlled by Bit15 of SATZANW. If MDI submode is active, the input for the motion command interface of the path interpolator will be taken from the signals:

- 810 Target Position (MDI_TARPOS)
- 811 Position Velocity (MDI_VELOCITY)
- 812 Position Acceleration (MDI_ACC)
- 813 Position Deceleration (MDI_DEC).

The new target position is set with the rising edge of STW1 Bit6.

Control Word

Listed in the following table are the bits in 967 Control Word 1 (STW1) that result in the corresponding state transitions of the general PROFIdrive state machine.

Bit	Name	Description
0	OFF/ON	Set this Bit to "1" to switch on the drive voltage. Power-down (OFF1) by setting this bit to "0"; the drive returns to the "Ready For Switching On" condition. The drive is ramped-down along the ramp . If/once in standstill, the main voltage is switched off.
1	Coast Stop	Set this bt to "1" to withdraw all "Coast Stop (OFF2)" commands. Set this bit to "0" to switch the voltage off. The drive goes into the "Switching On Inhibited" condition; the motor coasts down to a standstill.
2	Quick Stop	Set this bit to "1" to withdraw all "Quick Stop (OFF3)" commands. Set this bit to "0" to command a Quick stop. The drive is decelerated as fast as possible and´goes into the "Switching On Inhibited" condition. A Quick Stop command is not interruptible.
3	Enable Operaton	Set this bit to "1" to enable electronics and operation. Set this bit to "0" to disable operation. The drive coasts down to a standstill and goes into the "Switched on" condition.
7	Fault Acknowledge (0 -> 1)	The fault is acknowledged with a positive edge. If the fault reaction has switched off the voltage, the drive then goes into the "Switching On Inhibited" condition.
15	Enable Autosetup Mode	Activates the mode Auto setup. If set, the bit has higher priority as the setting in 930 Operating Mode **Note:** Becuase the PROFINET connection may get ldot during the autosetup, Nanotec recommends running the autosetup with the software *PNDS*. .

Following bits in the parameter 967 Control Word 1 (STW1) have a special function in this mode:

Bit	Name	Description
4	Reject Traversing Task (1> 0)	On a negative signal edge (1> 0), the drive brakes from an active Traversing Task with maximum deceleration and remains then stationary with the holding torque.The current Traversing Task is rejected.
5	Intermediate Stop	This bit shall reman continually set when executing a Traversing Task. On a negative signal edge (1> 0), the drive brakes from an active Traversing Task along a ramp, and remains stationary with the holding torque. The Traversing Task is not rejected and is continued when this bit changes to 1 again.
6	Activate Traversing Task (0 -> 1)	A positive signal edge enables a Traversing Task or a new MDI setpoint.
11	Start Homing Procedure	Set this Bit to "1" to start a Homing Procedure. Prerequisite: Operation is enabled. Set this bit from "1" to "0" to abort a Homing Procedure in progress., The drive stops along a ramp.
12	Change Set Not Immediately	The default behavior in PROFIdrive is that with the the next Bit 6 after a set point, a travel shall beginn again. By setting this bit to "1" you can send two travel commands the one after the other.
13	Change On Setpoint	If the first set point is not reached yet and this bit is set to "1", the travel is continued at the same velocity to the second set point.

Status Word

Listed in the following table are the bits in 968 Status Word 1 (ZSW1) that break down the state of the general PROFIdrive state machine.

Bit	Name	Description
0	Ready To Switch On	Power supply is switched on, electronics initialised,,pulses are inhibited.
1	Ready To Operate	Refer to bit 0 of controword 1. This bit remains set during deceleration following an OFF-command.
2	Operation Enabled	Electronic and pulses are enabled, drive follows setpoint (refer to controlword 1, bit 3).
3	Fault Present	Unacknowledged faults or currently not acknowledgeable faults (fault messages) are present (in the fault buffer).
4	Coast Stop (OFF 2)	If this bit is 0, a coast stop is active.
5	Quick Stop (OFF 3)	If this bit is 0, a quick stop is active.
6	Switching On Inhibited	This bit is set back to zero and the drive goes again in the "Switched On" condition only with "No Coast Stop AND "No Quick Stop" followed by an "ON-command".
7	Warning Present	Not acknowledged warning present in the buffer.
9	Control Requested	The PROFINET controller has the control and manages the PROFIdrive state machine.

Bit	Name	Description
		The value of the Bits is always "1"
15	Closed Loop Active	Bit set: Closed Loop is active

Following bits in the parameter 968 Status Word 1 (ZSW1) have a special function in this mode:

Bit	Name	Description
8	Following Error Within Tolerance Range	If this bit is "1", the dynamic comparison of the demand and actual position value is within the defined following error window.
10	Target Position Reached	If this bit is "1", the position actual value at the end of a Traversing Task is within the position window.
11	Home Position Set	If this bit is "1", a Homing was executed and Home Position is valid. Else, no valid Home Position is available.
12	Traversing Task Acknowledgment (0 -> 1)	Using the positive edge, it is acknowledged that a new Traversing Task or MDI setpoint was accepted.
13	Drive Stopped/Moving	Signals that a Traversing Task has been completed or a standstill for i(ntermediate) stop. If the bit is "0", a Traversing Task is executed and the actual speed is not zero.
14	Position Limit	Bit set: The drive is outside the set position limits (607Dh Software Position Limit).

Homing

The purpose of the homing is to align the position zero point of the controller with an encoder index or position switch. In 6098h Homing Method you define which of the available methodes is used.

To start a homing:

1. Set the PROFIdrive state machine via the Control Word in the state *Operation Enabled* or *Coast Stop* .
2. Set Bit 11 of the Control Word to "1".

When the homing is finished, Bit 11 of the Status Word is set to "1" and the state is automatically reset to the initial state.

Parameters used in this mode

- 800 Traverse Record Target Position
- 801 Traverse Record Position Velocity
- 802 Traversing Record Position Acceleration
- 803 Traversing Record Position Deceleration
- 808 Traverse Record Command Set Selection (SATZANW)
- 809 Traverse Record Current Command Set (AKTSATZ)
- 810 Target Position (MDI_TARPOS)
- 811 Position Velocity (MDI_VELOCITY)
- 812 Position Acceleration (MDI_ACC)
- 813 Position Deceleration (MDI_DEC)
- 819 Position Mode (MDI_MOD)
- 882 Begin Acceleration Jerk
- 883 Begin Deceleration Jerk

- 884 End Acceleration Jerk
- 885 End Deceleration Jerk
- 24679 (6067h Position Window)
- 24710 (6086h Motion Profile Type)
- 24818 (60F2h Position Option Code)
- 24699 (607Bh Position Range Limit)
- 24701 (607Dh Software Position Limit)

5.1.2 Speed Control

This mode operates the motor at a preset target speed, similar to a frequency inverter.

To activate the mode, set the parameter 930 Operating Mode to the value "1". In this mode you can use the Telegrams 1 or 2, the parameter is set automatically in this case.

The target velocity can be given as an N2 or N4 normalized value, depending on the telegram selection in PNU922. If PNU922 is equal to 2 then an N4 normalized value is assumed (NSOLL_B), else an N2 (NSOLL_A).

Control Word

Listed in the following table are the bits in 967 Control Word 1 (STW1) that result in the corresponding state transitions of the general PROFIdrive state machine.

Bit	Name	Description
0	OFF/ON	Set this Bit to "1" to switch on the drive voltage. Power-down (OFF1) by setting this bit to "0"; the drive returns to the "Ready For Switching On" condition. The drive is ramped-down along the ramp . If/once in standstill, the main voltage is switched off.
1	Coast Stop	Set this bt to "1" to withdraw all "Coast Stop (OFF2)" commands. Set this bit to "0" to switch the voltage off. The drive goes into the "Switching On Inhibited" condition; the motor coasts down to a standstill.
2	Quick Stop	Set this bit to "1" to withdraw all "Quick Stop (OFF3)" commands. Set this bit to "0" to command a Quick stop. The drive is decelerated as fast as possible and´goes into the "Switching On Inhibited" condition. A Quick Stop command is not interruptible.
3	Enable Operaton	Set this bit to "1" to enable electronics and operation. Set this bit to "0" to disable operation. The drive coasts down to a standstill and goes into the "Switched on" condition.
7	Fault Acknowledge (0 -> 1)	The fault is acknowledged with a positive edge. If the fault reaction has switched off the voltage, the drive then goes into the "Switching On Inhibited" condition.
15	Enable Autosetup Mode	Activates the mode Auto setup. If set, the bit has higher priority than the setting in 930 Operating Mode .

Bit	Name	Description
		Note: Becuase the PROFINET connection may get ldot during the autosetup, Nanotec recommends running the autosetup with the software *PNDS*.

Following bits in the parameter 967 Control Word 1 (STW1) have a special function in this mode:

Bit	Name	Description
4	Enable RFG	Enables the Ramp Function Generator (RFG). On a negative signal edge (1> 0), the drive brakes with maximum deceleration and remains then stationary with the holding torque.The current travel command is rejected.
5	Intermediate Stop	On a negative signal edge (1> 0), the drive brakes along a ramp, and remains stationary with the holding torque. The current travel command is not rejected and is continued when this bit changes to 1 again.
6	Enable Setpoint	A positive signal edge enables a new setpoint.

Status Word

Listed in the following table are the bits in 968 Status Word 1 (ZSW1) that break down the state of the general PROFIdrive state machine.

Bit	Name	Description
0	Ready To Switch On	Power supply is switched on, electronics initialised,,pulses are inhibited.
1	Ready To Operate	Refer to bit 0 of controword 1. This bit remains set during deceleration following an OFF-command.
2	Operation Enabled	Electronic and pulses are enabled, drive follows setpoint (refer to controlword 1, bit 3).
3	Fault Present	Unacknowledged faults or currently not acknowledgeable faults (fault messages) are present (in the fault buffer).
4	Coast Stop (OFF 2)	If this bit is 0, a coast stop is active.
5	Quick Stop (OFF 3)	If this bit is 0, a quick stop is active.
6	Switching On Inhibited	This bit is set back to zero and the drive goes again in the "Switched On" condition only with "No Coast Stop AND "No Quick Stop" followed by an "ON-command".
7	Warning Present	Not acknowledged warning present in the buffer.
9	Control Requested	The PROFINET controller has the control and manages the PROFIdrive state machine. The value of the Bits is always "1"
15	Closed Loop Active	Bit set: Closed Loop is active

Following bits in the parameter 968 Status Word 1 (ZSW1) have a special function in this mode:

Bit	Name	Description
8	Speed Error Within Tolerance Range	If this bit is "1", the dynamic comparison of the demand and actual position value is within the defined following error window.
10	Target Speed Reached	If this bit is "1", the target speed is reached.

Parameters used in this mode

- 820 Target Velocity NSOLL_A: Target Velocity N2 (depending on the telegram selected in parameter 922)
- 821 Actual Velocity NIST_A: Actual Velocity N2
- 822 Target Velocity NSOLL_B: Target Velocity N4 (depending on the telegram selected in parameter 922)
- 823 Actual Velocity NIST_B: Actual Velocity N4
- 830 Speed Error Tolerance Range
- 831 Speed Error Tolerance Time
- 872 Speed Control Acceleration
- 873 Speed Control Deceleration
- 882 Begin Acceleration Jerk
- 883 Begin Deceleration Jerk
- 884 End Acceleration Jerk
- 885 End Deceleration Jerk
- 24710 (6086h Motion Profile Type)

5.1.3 Torque

This mode is a manufacturer specific mode where the torque is the set value and is reached via a ramp function.

To activate the mode, set the parameter 03A2h Operating Mode to the value "8004_h". In this mode you can use the Telegram 200, the parameter is set automatically in this case.

Control Word

Listed in the following table are the bits in 03C7h Control Word 1 (STW1) that result in the corresponding state transitions of the general PROFIdrive state machine.

Bit	Name	Description
0	OFF/ON	Set this Bit to "1" to switch on the drive voltage. Power-down (OFF1) by setting this bit to "0"; the drive returns to the "Ready For Switching On" condition. The drive is ramped-down along the ramp . If/once in standstill, the main voltage is switched off.
1	Coast Stop	Set this bt to "1" to withdraw all "Coast Stop (OFF2)" commands. Set this bit to "0" to switch the voltage off. The drive goes into the "Switching On Inhibited" condition; the motor coasts down to a standstill.
2	Quick Stop	Set this bit to "1" to withdraw all "Quick Stop (OFF3)" commands. Set this bit to "0" to command a Quick stop. The drive is decelerated as fast as possible and´goes into the "Switching On Inhibited" condition. A Quick Stop command is not interruptible.

Bit	Name	Description
3	Enable Operaton	Set this bit to "1" to enable electronics and operation. Set this bit to "0" to disable operation. The drive coasts down to a standstill and goes into the "Switched on" condition.
7	Fault Acknowledge (0 -> 1)	The fault is acknowledged with a positive edge. If the fault reaction has switched off the voltage, the drive then goes into the "Switching On Inhibited" condition.
15	Enable Autosetup Mode	Activates the mode Auto setup. If set, the bit has higher priority than the setting in 03A2h Operating Mode . **Note:** Becuase the PROFINET connection may get ldot during the autosetup, Nanotec recommends running the autosetup with the software *PNDS*.

Following bits in the parameter 03C7h Control Word 1 (STW1) have a special function in this mode:

Bit	Name	Description
5	Intermediate Stop	On a negative signal edge (1> 0), the drive brakes along a ramp, and remains stationary with the holding torque. The current travel command is not rejected and is continued when this bit changes to 1 again.
6	Enable Setpoint	A positive signal edge enables a new torque setpoint.
11	Enable *Real Torque Mode*	Set this bit to "1" to activate the *Real Torque Mode*. The torque controller is active (otherwise a velocity controller is superimposed.) No V-controller is used in the torque mode for speed limiting, thus the limitation in 841 Torque Max Velocity is ignored. If the bit is set, bit 5 in 3202_h ignored.

Status Word

Listed in the following table are the bits in 03C8h Status Word 1 (ZSW1) that break down the state of the general PROFIdrive state machine.

Bit	Name	Description
0	Ready To Switch On	Power supply is switched on, electronics initialised,,pulses are inhibited.
1	Ready To Operate	Refer to bit 0 of controword 1. This bit remains set during deceleration following an OFF-command.
2	Operation Enabled	Electronic and pulses are enabled, drive follows setpoint (refer to controlword 1, bit 3).
3	Fault Present	Unacknowledged faults or currently not acknowledgeable faults (fault messages) are present (in the fault buffer).
4	Coast Stop (OFF 2)	If this bit is 0, a coast stop is active.
5	Quick Stop (OFF 3)	If this bit is 0, a quick stop is active.

Bit	Name	Description
6	Switching On Inhibited	This bit is set back to zero and the drive goes again in the "Switched On" condition only with "No Coast Stop AND "No Quick Stop" followed by an "ON-command".
7	Warning Present	Not acknowledged warning present in the buffer.
9	Control Requested	The PROFINET controller has the control and manages the PROFIdrive state machine. The value of the Bits is always "1"
15	Closed Loop Active	Bit set: Closed Loop is active

Following bits in the parameter 03C8h Status Word 1 (ZSW1) have a special function in this mode:

Bit	Name	Description
10	Target Torque Reached	If this bit is "1", the target torque is reached.
14	Limit Exceeded	If this bit is "1", the torque (current) is being limited (see I2t Motor overload protection)

Parameters used in this mode

- 2031h Max Motor Current
- 203Bh I2t Parameters
- 203Dh Torque Window
- 203Eh Torque Window Time Out
- 3202h Motor Drive Submode Select: Bit 5
- 6071h Target Torque
- 0349h Torque Max Velocity
- 6080h Max Motor Speed
- 6087h Torque Slope

5.2 PROFIdrive Object Dictionary

5.2.1 Overview

This chapter contains a description of all PROFIdrive parameters. In the chapter Description of the CiA 402 object dictionary you can find a description of all objects that the product supports, including the Nanotec objects based on the CiA 402 device profile. PROFIDrive uses decimal notation for parameter numbers. If a parameter/object is noted in hexadecimal in this document, it is an object from the CiA 402 profile.

You will find information here on:

- Functions
- Object descriptions ("Index")
- Value descriptions ("Subindices")
- Descriptions of bits
- Description of the object

NOTICE

In PROFIdrive there is no separate sub-index for the array length. When you access sub-index 0 (*Number Of Entries*) of an array via PROFINET, you access in reality sub-index 1 and thus directly the data.

5.2.2 Data types

The data type (size and interpretation) of the entry is specified for each parameter. Following data types are supported:.

- STRING
- UNSIGNED 8,16 or 32 bit
- INTEGER (=SIGNED) 8,16 or 32
- REAL (=FLOAT) 8,16 or 32 bit
- V2: The object consists of 16 boolean variables (bits) in two Octets.
- N2/N4: Linear normalised value (SINT16 for N2 and SINT32 for N4). 0 % corresponds to 0, 100 % of the reference value corresponds to 2^{14} for N2 or 2^{30} for N4 resp.

715 Selection Switch For DO IO Data (subindex) In The Setpoint Telegram

Function

In this parameter you enter the sub-index of the parameter to map. See Add parameters.

Object description

Index	$02CB_h$
Object name	Selection Switch For DO IO Data (subindex) In The Setpoint Telegram
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h
Name	Subindex 1
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Subindex 2
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Subindex 3
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Subindex 4
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	Subindex 5
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	Subindex 6
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	Subindex 7
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	Subindex 8
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	Subindex 9
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	Subindex 10
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	Subindex 11
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	Subindex 12
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	$0D_h$
Name	Subindex 13
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	Subindex 14
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	Subindex 15
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	Subindex 16
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

716 Selection Switch For DO IO Data (subindex) In The Actual Value Telegram

Function

In this parameter you enter the sub-index of the parameter to map. See Add parameters.

Object description

Index	$02CC_h$
Object name	Selection Switch For DO IO Data (subindex) In The Actual Value Telegram

Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h
Name	Subindex 1
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Subindex 2
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Subindex 3
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Subindex 4
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	Subindex 5
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	Subindex 6
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	Subindex 7
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	Subindex 8
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	Subindex 9
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	Subindex 10
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	Subindex 11
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	Subindex 12
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	Subindex 13
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	Subindex 14
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	$0F_h$
Name	Subindex 15
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	Subindex 16
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

750 Control Word 2 (STW2)

Function

Reserved for future use.

Object description

Index	$02EE_h$
Object name	Control Word 2 (STW2)
Object Code	VARIABLE
Data type	V2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

751 Status Word 2 (ZSW2)

Function

Reserved for future use.

Object description

Index	$02EF_h$
Object name	Status Word 2 (ZSW2)

Object Code	VARIABLE
Data type	V2
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

752 Automatic Telegram Assignment

Function

With this parameter you determine the source for the telegram selection,

Object description

Index	$02F0_h$
Object name	Automatic Telegram Assignment
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

- Value "0" The telegram is selected via the PROFINET project planning and the selected telegram is shown in 922 Telegram Selection.
- Value "1": You select the telegram via the PROFIdrive parameter 922 Telegram Selection.

752 Automatic Telegram Assignment

Function

With this parameter you determine the source for the telegram selection,

Object description

Index	$02F0_h$
Object name	Automatic Telegram Assignment
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	no

Allowed values	
Preset value	0001_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

- Value "0" The telegram is selected via the PROFINET project planning and the selected telegram is shown in 922 Telegram Selection.
- Value "1": You select the telegram via the PROFIdrive parameter 922 Telegram Selection.

800 Traverse Record Target Position

Function

This object contains the target positions of the 32 motion records for the mode Positioning, which you can selet via the parameter 808 Traverse Record Command Set Selection.

Object description

Index	0320_h
Object name	Traverse Record Target Position
Object Code	ARRAY
Data type	INTEGER32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	20_h

Subindex	01_h
Name	1th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	

Preset value	00000000_h

Subindex	02_h
Name	2nd Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	3rd Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	4th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	5th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	6th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	07_h

Name	7th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	8th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	09_h
Name	9th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0A_h$
Name	10th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0B_h$
Name	11th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0C_h$
Name	12th Set
Data type	INTEGER32
Access	read / write

PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0D_h$
Name	13th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0E_h$
Name	14th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0F_h$
Name	15th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	10_h
Name	16th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	11_h
Name	17th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	12_h
Name	18th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	13_h
Name	19th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	14_h
Name	20th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	15_h
Name	21th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	16_h
Name	22th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	17_h
Name	23th Set
Data type	INTEGER32

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	18_h
Name	24th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	19_h
Name	25th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1A_h$
Name	26th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1B_h$
Name	27th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1C_h$
Name	28th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	

Preset value	00000000_h

Subindex	$1D_h$
Name	29th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1E_h$
Name	30th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1F_h$
Name	31th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	20_h
Name	32th Set
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

801 Traverse Record Position Velocity

Function

This object contains the profile velocities of the 32 motion records for the mode Positioning, which you can selet via the parameter 808 Traverse Record Command Set Selection.

Object description

Index	0321_h
Object name	Traverse Record Position Velocity

Object Code	ARRAY
Data type	N4
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	20_h

Subindex	01_h
Name	1st Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	2nd Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	3rd Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	4th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	5th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	6th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	07_h
Name	7th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	8th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	09_h
Name	9th Set
Data type	N4

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0A_h$
Name	10th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0B_h$
Name	11th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0C_h$
Name	12th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0D_h$
Name	13th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0E_h$
Name	14th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	

Preset value	00000000_h

Subindex	$0F_h$
Name	15th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	10_h
Name	16th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	11_h
Name	17th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	12_h
Name	18th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	13_h
Name	19th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	14_h

Name	20th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	15_h
Name	21th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	16_h
Name	22th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	17_h
Name	23th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	18_h
Name	24th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	19_h
Name	25th Set
Data type	N4
Access	read / write

PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1A_h$
Name	26th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1B_h$
Name	27th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1C_h$
Name	28th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1D_h$
Name	29th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1E_h$
Name	30th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$1F_h$
Name	31th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	20_h
Name	32th Set
Data type	N4
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

N4-normalised value, refers to 60000 Velocity Reference Value.

802 Traversing Record Position Acceleration

Function

This object contains the profile accelrations of the 32 motion records for the mode Positioning, which you can selet via the parameter 808 Traverse Record Command Set Selection.

Object description

Index	0322_h
Object name	Traversing Record Position Acceleration
Object Code	ARRAY
Data type	N2
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no

Allowed values	
Preset value	20_h

Subindex	01_h
Name	1st Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	2nd Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	3rd Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	4th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	5th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	6th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	7th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	8th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	9th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	10th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	11th Set
Data type	N2

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	12th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	13th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	14th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	15th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	16th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	11_h
Name	17th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	12_h
Name	18th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	13_h
Name	19th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	14_h
Name	20th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	15_h
Name	21th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	16_h

Name	22th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	17_h
Name	23th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	18_h
Name	24th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	19_h
Name	25th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1A_h$
Name	26th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1B_h$
Name	27th Set
Data type	N2
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1C_h$
Name	28th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1D_h$
Name	29th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1E_h$
Name	30th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1F_h$
Name	31th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	20_h
Name	32th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

803 Traversing Record Position Deceleration

Function

This object contains the profile decelerations of the 32 motion records for the mode Positioning, which you can selet via the parameter 808 Traverse Record Command Set Selection.

Object description

Index	0323_h
Object name	Traversing Record Position Deceleration
Object Code	ARRAY
Data type	N2
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	20_h

Subindex	01_h
Name	1st Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	2nd Set
Data type	N2
Access	read / write
PDO mapping	no

Allowed values	
Preset value	0000_h

Subindex	03_h
Name	3rd Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	4th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	5th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	6th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	7th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	8th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	9th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	10th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	11th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	12th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	13th Set
Data type	N2

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	14th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	15th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	16th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	11_h
Name	17th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	12_h
Name	18th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	13_h
Name	19th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	14_h
Name	20th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	15_h
Name	21th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	16_h
Name	22th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	17_h
Name	23th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	18_h

Name	24th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	19_h
Name	25th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1A_h$
Name	26th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1B_h$
Name	27th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1C_h$
Name	28th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1D_h$
Name	29th Set
Data type	N2
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1E_h$
Name	30th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1F_h$
Name	31th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	20_h
Name	32th Set
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

808 Traverse Record Command Set Selection

Function

With this parameter you pre-select one of the 32 stored motion records. This will be carried out at the next positioning start. You can transfer the parameter (signal SATZANW) directly via the PROFINET telegrams 7, 9, 207 or 209.

Object description

Index	0328_h
Object name	Traverse Record Command Set Selection
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

In the bits 0 to 9 you enter the number of the motion record. If you set bBit 15 to "1", the positioning mode switches to the Manual Data Input.

809 Traverse Record Current Command Set

Function

In this parameter you read which of the 32 stored motion records is currently selected. You can read the parameter (signal AKTSATZ) directly via the PROFINET telegrams 7, 9, 207 or 209.

Object description

Index	0329_h
Object name	Traverse Record Current Command Set
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

810 Target Position

Function

In this parameter you enter the target position for the positioning mode Manual Data Input. You can transfer the parameter (signal MDI_TARPOS) directly via the PROFINET telegram 9 or 209.

Object description

Index	$032A_h$
Object name	Target Position
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Firmware version	FIR-v2139-B1020888
Change history	

811 Position Velocity

Function

In this parameter you enter the profile velocity for the positioning mode Manual Data Input. You can transfer the parameter (signal MDI_VELOCITY) directly via the PROFINET telegram 9 or 209.

Object description

Index	$032B_h$
Object name	Position Velocity
Object Code	VARIABLE
Data type	N4
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N4-normalised value, refers to 60000 Velocity Reference Value.

812 Position Acceleration

Function

In this parameter you enter the profile acceleration for the positioning mode Manual Data Input. You can transfer the parameter (signal MDI_ACC) directly via the PROFINET telegram 9 or 209.

Object description

Index	$032C_h$
Object name	Position Acceleration
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

813 Position Deceleration

Function

In this parameter you enter the profile deceleration for the positioning mode Manual Data Input. You can transfer the parameter (signal MDI_dec) directly via the PROFINET telegram 9 or 209.

Object description

Index	$032D_h$
Object name	Position Deceleration
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

819 Position Mode

Function

The parameter describes the positioning behavior in the Manual Data Input mode.

Object description

Index	0333_h
Object name	Position Mode
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

Bit 0 (Absolute/Relative positioning mode)

Value = 1: The target position in the signal TARPOS defines the absolute target position for the motion.

Value = 0. The target position in the signal TARPOS defines the relative target position for the motion related to the actual axis position.

Bit 1 (Positive Modulo positioning direction)

This command is only functional if the absolute position mode is activated (bit 0 = 1).

Value 1: The absolute position shall be reached by a motion in the positive direction. If bit 1 and bit 2 are both "1", the target position shall be reached by the shortest path.

Value 0 If bits 1 and 2 are both "0", the target position shall be reached by the shortest path.

Bit 2 (Negative Modulo positioning direction)

This command is only functional if the absolute position mode is activated (bit 0 = 1).

Value= 1: The absolute position shall be reached by a motion in the negative direction. If bit 1 and bit 2 are both "1", the target position shall be reached by the shortest path.

Value= 0 If bits 1 and 2 are both "0", the target position shall be reached by the shortest path.

820 Target Velocity NSOLL_A

Function

Target velocity for the mode Speed Control.

Object description

Index	0334_h
Object name	Target Velocity NSOLL_A
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 60000 Velocity Reference Value,

821 Actual Velocity NIST_A

Function

Actual velocity in the mode Speed Control.

Object description

Index	0335_h
Object name	Actual Velocity NIST_A
Object Code	VARIABLE
Data type	N2
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 60000 Velocity Reference Value,

822 Target Velocity NSOLL_B

Function

Target velocity for the mode Speed Control.

Object description

Index	0336_h
Object name	Target Velocity NSOLL_B
Object Code	VARIABLE
Data type	N4
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N4-normalised value, refers to 60000 Velocity Reference Value,

823 Actual Velocity NIST_B

Function

Actual velocity in the mode Speed Control.

Object description

Index	0337_h

Object name	Actual Velocity NIST_B
Object Code	VARIABLE
Data type	N4
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N4-normalised value, refers to 60000 Velocity Reference Value,

824 Homing Speed

Function

Set point velocity for the mode Homing.

Object description

Index	0338_h
Object name	Homing Speed
Object Code	ARRAY
Data type	N2
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Value #1
Data type	N2

Access	read / write
PDO mapping	no
Allowed values	
Preset value	$00B0_h$

Subindex	02_h
Name	Value #2
Data type	N2
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0036_h

Description

N2-normalised value, refers to 60000 Velocity Reference Value,

825 Homing Acceleration

Function

Acceleration and deceleration for the mode Homing.

Object description

Index	0339_h
Object name	Homing Acceleration
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	2000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

830 Speed Error Tolerance Range

Function

Defines the maximum allowed slippage error symmetrically to the set speed in Speed Control mode.

Object description

Index	$033E_h$
Object name	Speed Error Tolerance Range

Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 60000 Velocity Reference Value,

If the actual speed deviates so much from the set speed that the value (absolute value) of this parameter is exceeded, a slippage error is triggered. The deviation must last longer than the time in 831 Speed Error Tolerance Time.

831 Speed Error Tolerance Time

Function

Time in milliseconds until an excessively large slippage error in Speed Control mode results in an error message.

Object description

Index	$033F_h$
Object name	Speed Error Tolerance Time
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

If the actual speed deviates so much from the set speed that the value (absolute value) of 830 Speed Error Tolerance Range is exceeded, a slippage error is triggered. The deviation must last longer than the time in this parameter.

841 Torque Max Velocity

Function

Target velocity for the Torque mode.

Object description

Index	0349_h
Object name	Torque Max Velocity
Object Code	VARIABLE
Data type	N4
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	40000000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N4-normalised value, refers to 60000 Velocity Reference Value,

872 Speed Control Acceleration

Function

Acceleration for the mode Speed Control.

Object description

Index	0368_h
Object name	Speed Control Acceleration
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value,

873 Speed Control Deceleration

Function

Deceleration for the mode Speed Control.

Object description

Index	0369_h

Object name	Speed Control Deceleration
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value,

882 Begin Acceleration Jerk

Function

Initial jerk during acceleration for the modes Positioning and Speed Control. Is taken into account only when the 6086h Motion Profile Type is set to "3" (jerk limited ramp).

Object description

Index	0372_h
Object name	Begin Acceleration Jerk
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

883 Begin Deceleration Jerk

Function

Initial jerk during braking for the modes Positioning and Speed Control. Is taken into account only when the 6086h Motion Profile Type is set to "3" (jerk limited ramp).

Object description

Index	0373_h
Object name	Begin Deceleration Jerk
Object Code	VARIABLE

Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

884 End Acceleration Jerk

Function

Final jerk during acceleration for the modes Positioning and Speed Control. Is taken into account only when the 6086h Motion Profile Type is set to "3" (jerk limited ramp).

Object description

Index	0374_h
Object name	End Acceleration Jerk
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

885 End Deceleration Jerk

Function

Final jerk during braking for the modes Positioning and Speed Control. Is taken into account only when the 6086h Motion Profile Type is set to "3" (jerk limited ramp).

Object description

Index	0375_h
Object name	End Deceleration Jerk
Object Code	VARIABLE
Data type	N2
Savable	yes, category: application

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

N2-normalised value, refers to 898 Acceleration Reference Value.

898 Acceleration Reference Value

Function

Reference for all accelration and deceleration values in the PROFIdrive Object Dictionary. Specified in $1/s^2$.

Object description

Index	0382_h
Object name	Acceleration Reference Value
Object Code	VARIABLE
Data type	REAL32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	500.0f
Firmware version	FIR-v2139-B1020888
Change history	

899 Jerk Reference Value

Function

Reference for all jerk values in the PROFIdrive Object Dictionary. Specified in $1/s^3$.

Object description

Index	0383_h
Object name	Jerk Reference Value
Object Code	VARIABLE
Data type	REAL32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	1000.0f
Firmware version	FIR-v2139-B1020888
Change history	

915 Selection Switch For DO IO Data In The Setpoint Telegram

Function

In this parameter you enter the index of the parameter to map. See Add parameters.

Object description

Index	0393_h
Object name	Selection Switch For DO IO Data In The Setpoint Telegram
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h
Name	DO IO Data 1
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	DO IO Data 2
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	DO IO Data 3
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	DO IO Data 4
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	DO IO Data 5
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	DO IO Data 6
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	DO IO Data 7
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	DO IO Data 8
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	DO IO Data 9
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	DO IO Data 10
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	DO IO Data 11
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	DO IO Data 12
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	DO IO Data 13
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	$0E_h$
Name	DO IO Data 14
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	DO IO Data 15
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	DO IO Data 16
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

916 Selection Switch For DO IO Data In The Actual Value Telegram

Function

In this parameter you enter the index of the parameter to map. See Add parameters.

Object description

Index	0394_h
Object name	Selection Switch For DO IO Data In The Actual Value Telegram
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h
Name	DO IO Data 1
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	DO IO Data 2
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	DO IO Data 3
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	DO IO Data 4
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	DO IO Data 5

Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	DO IO Data 6
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	DO IO Data 7
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	DO IO Data 8
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	DO IO Data 9
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	DO IO Data 10
Data type	UNSIGNED16
Access	read / write
PDO mapping	no

Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	DO IO Data 11
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	DO IO Data 12
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	DO IO Data 13
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	DO IO Data 14
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	DO IO Data 15
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	DO IO Data 16
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

922 Telegram Selection

Function

With this object you select the desired telegram.

Object description

Index	$039A_h$
Object name	Telegram Selection
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

To select one of the supported telegrams, you enter here its number.

Should you need more parameters in addition to the parameters in the selected telegram, set PNU 922 to "0", in order to be able to Add parameters.

923 List Of All Parameters For Signals

Function

All PROFIdrive parameters are listed here with their signal number for the PROFINET-Telegrams.

Object description

Index	$039B_h$
Object name	List Of All Parameters For Signals
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	

Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	64_h

Subindex	01_h
Name	Signal 1
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Signal 2
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03C7_h$

Subindex	03_h
Name	Signal 3
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03C8_h$

Subindex	04_h
Name	Signal 4
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	$02EE_h$

Subindex	05_h
Name	Signal 5
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$02EF_h$

Subindex	06_h
Name	Signal 6
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0334_h

Subindex	07_h
Name	Signal 7
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0335_h

Subindex	08_h
Name	Signal 8
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0336_h

Subindex	09_h
Name	Signal 9
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0337_h

Subindex	$0A_h$

Name	Signal 10
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	Signal 11
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	Signal 12
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	Signal 13
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	Signal 14
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	Signal 15
Data type	UNSIGNED16
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	Signal 16
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	11_h
Name	Signal 17
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	12_h
Name	Signal 18
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	13_h
Name	Signal 19
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	14_h
Name	Signal 20
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	15_h
Name	Signal 21
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	16_h
Name	Signal 22
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	17_h
Name	Signal 23
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	18_h
Name	Signal 24
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	19_h
Name	Signal 25
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1A_h$
Name	Signal 26
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1B_h$
Name	Signal 27
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1C_h$
Name	Signal 28
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	6064_h

Subindex	$1D_h$
Name	Signal 29
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1E_h$
Name	Signal 30
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1F_h$
Name	Signal 31
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	20_h
Name	Signal 32
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$02F1_h$

Subindex	21_h
Name	Signal 33
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$02F2_h$

Subindex	22_h
Name	Signal 34
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0320_h

Subindex	23_h
Name	Signal 35
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0321_h

Subindex	24_h
Name	Signal 36
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0322_h

Subindex	25_h

Name	Signal 37
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0323_h

Subindex	26_h
Name	Signal 38
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0324_h

Description

Example: Signal 2 is the parameter 967 Control Word 1 (STW1).

930 Operating Mode

Function

Via this parameter you select the operation mode.

Object description

Index	$03A2_h$
Object name	Operating Mode
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0003_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

Follwing modes are supported

- 0000_h (None): No PROFIdrive mode is selected, You can use the further Nanotec CiA 402 operating modes and state machine.
- 0001_h: Speed Control
- 0002_h: Positioning
- 8000_h: Auto setup. For the auto setup you can use any telegram with STW1 and ZSW1and start the auto setup via STW1.Bit6.
- 8004_h: Torque

944 Fault Message Counter

Function

The counter Is incremented each time that the fault buffer changes. It is erased if you reset the 952 Fault Situation Counter to 0.

Object description

Index	$03B0_h$
Object name	Fault Message Counter
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

945 Fault Code

Function

Contains the fault code for each fault in each fault situation.

Object description

Index	$03B1_h$
Object name	Fault Code
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	

Preset value	40_h

Subindex	01_h
Name	Actual Fault Situation N, Fault Code 1 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Actual Fault Situation N, Fault Code 2 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Actual Fault Situation N, Fault Code 3 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Actual Fault Situation N, Fault Code 4 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	Actual Fault Situation N, Fault Code 5 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h

Name	Actual Fault Situation N, Fault Code 6 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	Actual Fault Situation N, Fault Code 7 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	Actual Fault Situation N, Fault Code 8 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	Fault Situation N-1, Fault Code 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	Fault Situation N-1, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	Fault Situation N-1, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	Fault Situation N-1, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	Fault Situation N-1, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	Fault Situation N-1, Fault Code 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	Fault Situation N-1, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	Fault Situation N-1, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	11_h
Name	Fault Situation N-2, Fault Code 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	12_h
Name	Fault Situation N-2, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	13_h
Name	Fault Situation N-2, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	14_h
Name	Fault Situation N-2, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	15_h
Name	Fault Situation N-2, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	16_h
Name	Fault Situation N-2, Fault Code 6 Is Acked
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	17_h
Name	Fault Situation N-2, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	18_h
Name	Fault Situation N-2, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	19_h
Name	Fault Situation N-3, Fault Code 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1A_h$
Name	Fault Situation N-3, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1B_h$
Name	Fault Situation N-3, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	$1C_h$
Name	Fault Situation N-3, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1D_h$
Name	Fault Situation N-3, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1E_h$
Name	Fault Situation N-3, Fault Code 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1F_h$
Name	Fault Situation N-3, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	20_h
Name	Fault Situation N-3, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	21_h

Name	Fault Situation N-4, Fault Code 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	22_h
Name	Fault Situation N-4, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	23_h
Name	Fault Situation N-4, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	24_h
Name	Fault Situation N-4, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	25_h
Name	Fault Situation N-4, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	26_h
Name	Fault Situation N-4, Fault Code 6 Is Acked
Data type	UNSIGNED16
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	27_h
Name	Fault Situation N-4, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	28_h
Name	Fault Situation N-4, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	29_h
Name	Fault Situation N-5, Fault Code 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2A_h$
Name	Fault Situation N-5, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2B_h$
Name	Fault Situation N-5, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2C_h$
Name	Fault Situation N-5, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2D_h$
Name	Fault Situation N-5, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2E_h$
Name	Fault Situation N-5, Fault Code 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2F_h$
Name	Fault Situation N-5, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	30_h
Name	Fault Situation N-5, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	31_h
Name	Fault Situation N-6, Fault Code 1 Is Acked
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	32_h
Name	Fault Situation N-6, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	33_h
Name	Fault Situation N-6, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	34_h
Name	Fault Situation N-6, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	35_h
Name	Fault Situation N-6, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	36_h
Name	Fault Situation N-6, Fault Code 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	37_h
Name	Fault Situation N-6, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	38_h
Name	Fault Situation N-6, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	39_h
Name	Fault Situation N-7, Fault Code 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3A_h$
Name	Fault Situation N-7, Fault Code 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3B_h$
Name	Fault Situation N-7, Fault Code 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3C_h$

Name	Fault Situation N-7, Fault Code 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3D_h$
Name	Fault Situation N-7, Fault Code 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3E_h$
Name	Fault Situation N-7, Fault Code 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3F_h$
Name	Fault Situation N-7, Fault Code 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	40_h
Name	Fault Situation N-7, Fault Code 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Description

Refer to the following table for the meaning of the codes:

Code	Description
1000_h	General error
2300_h	Current at the controller output too large
3100_h	Overvoltage/undervoltage at controller input
4200_h	Temperature error within the controller
5440_h	Interlock error: Bit 3 in $60FD_h$ is set to "0", the motor may not start (see the section *Interlock function* in the chapter Digital inputs)
6010_h	Software reset (watchdog)
6100_h	Internal software error, generic
6320_h	Rated current must be set ($203B_h$:01_h/6075_h)
7113_h	Warning: Ballast resistor thermally overloaded
7121_h	Motor blocked
7200_h	Internal error: Correction factor for reference voltage missing in the OTP
7305_h	Sensor 1 (see 3204_h) faulty
7306_h	Sensor 2 (see 3204_h) faulty
7307_h	Sensor n (see 3204_h), where n is greater than 2
7600_h	Warning: Nonvolatile memory full or corrupt; restart the controller for cleanup work
8400_h	Error in speed monitoring: slippage error too large
8611_h	Position monitoring error: Following error too large
8612_h	Position monitoring error: Limit switch exceeded

947 Fault Number

Function

Contains the fault number for each fault in each fault situation.

Object description

Index	$03B3_h$
Object name	Fault Number
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only

PDO mapping	no
Allowed values	
Preset value	40_h

Subindex	01_h
Name	Actual Fault Situation N, Fault Number 1 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Actual Fault Situation N, Fault Number 2 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Actual Fault Situation N, Fault Number 3 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Actual Fault Situation N, Fault Number 4 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	Actual Fault Situation N, Fault Number 5 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	Actual Fault Situation N, Fault Number 6 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	Actual Fault Situation N, Fault Number 7 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	Actual Fault Situation N, Fault Number 8 Is Not Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	Fault Situation N-1, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	Fault Situation N-1, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	Fault Situation N-1, Fault Number 3 Is Acked
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	Fault Situation N-1, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0D_h$
Name	Fault Situation N-1, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0E_h$
Name	Fault Situation N-1, Fault Number 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$0F_h$
Name	Fault Situation N-1, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	10_h
Name	Fault Situation N-1, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	11_h
Name	Fault Situation N-2, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	12_h
Name	Fault Situation N-2, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	13_h
Name	Fault Situation N-2, Fault Number 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	14_h
Name	Fault Situation N-2, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	15_h
Name	Fault Situation N-2, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	16_h

Name	Fault Situation N-2, Fault Number 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	17_h
Name	Fault Situation N-2, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	18_h
Name	Fault Situation N-2, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	19_h
Name	Fault Situation N-3, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1A_h$
Name	Fault Situation N-3, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1B_h$
Name	Fault Situation N-3, Fault Number 3 Is Acked
Data type	UNSIGNED16
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1C_h$
Name	Fault Situation N-3, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1D_h$
Name	Fault Situation N-3, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1E_h$
Name	Fault Situation N-3, Fault Number 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$1F_h$
Name	Fault Situation N-3, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	20_h
Name	Fault Situation N-3, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	21_h
Name	Fault Situation N-4, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	22_h
Name	Fault Situation N-4, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	23_h
Name	Fault Situation N-4, Fault Number 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	24_h
Name	Fault Situation N-4, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	25_h
Name	Fault Situation N-4, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	26_h
Name	Fault Situation N-4, Fault Number 6 Is Acked
Data type	UNSIGNED16

Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	27_h
Name	Fault Situation N-4, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	28_h
Name	Fault Situation N-4, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	29_h
Name	Fault Situation N-5, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2A_h$
Name	Fault Situation N-5, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2B_h$
Name	Fault Situation N-5, Fault Number 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	

Preset value	0000_h

Subindex	$2C_h$
Name	Fault Situation N-5, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2D_h$
Name	Fault Situation N-5, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2E_h$
Name	Fault Situation N-5, Fault Number 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$2F_h$
Name	Fault Situation N-5, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	30_h
Name	Fault Situation N-5, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	31_h

Name	Fault Situation N-6, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	32_h
Name	Fault Situation N-6, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	33_h
Name	Fault Situation N-6, Fault Number 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	34_h
Name	Fault Situation N-6, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	35_h
Name	Fault Situation N-6, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	36_h
Name	Fault Situation N-6, Fault Number 6 Is Acked
Data type	UNSIGNED16
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	37_h
Name	Fault Situation N-6, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	38_h
Name	Fault Situation N-6, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	39_h
Name	Fault Situation N-7, Fault Number 1 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3A_h$
Name	Fault Situation N-7, Fault Number 2 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3B_h$
Name	Fault Situation N-7, Fault Number 3 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3C_h$
Name	Fault Situation N-7, Fault Number 4 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3D_h$
Name	Fault Situation N-7, Fault Number 5 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3E_h$
Name	Fault Situation N-7, Fault Number 6 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	$3F_h$
Name	Fault Situation N-7, Fault Number 7 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	40_h
Name	Fault Situation N-7, Fault Number 8 Is Acked
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Description

This can be used to pinpoint the cause of the error. The meaning of the number can be found in the following table:

Error number	Description
0	Watchdog-Reset
1	Input voltage (+Ub) too high
2	Output current too high
3	Input voltage (+Ub) too low
4	Error at fieldbus
7	Sensor 1 (see 3204_h): Error through electrical fault or defective hardware
8	Sensor 2 (see 3204_h): Error through electrical fault or defective hardware
9	Sensor 3 (see 3204_h): Error through electrical fault or defective hardware
10	Warning: Positive limit switch exceeded
11	Warning: Negative limit switch exceeded
12	Overtemperature error
13	The values of object 6065_h (Following Error Window) and object 6066_h (Following Error Time Out) were exceeded; a fault was triggered.
14	Warning: Nonvolatile memory full. The current save process could not be completed; parts of the data of the save process are lost. Controller must be restarted for cleanup work.
15	Motor blocked
16	Warning: Nonvolatile memory damaged; controller must be restarted for cleanup work (all saved objects are reset to default).
17	CANopen only: Slave took too long to send PDO messages.
18	Sensor n (see 3204_h), where n is greater than 3: Error through electrical fault or defective hardware
19	CANopen only: PDO not processed due to a length error
20	CANopen only: PDO length exceeded
21	Warning: Restart the controller to avoid future errors when saving (nonvolatile memory full/corrupt).
22	Rated current must be set ($203B_h$:01_h/6075_h)
23	Encoder resolution, number of pole pairs and some other values are incorrect.
24	Motor current is too high, adjust the PI parameters.
25	Internal software error, generic
26	Current too high at digital output
30	Error in speed monitoring: slippage error too large
32	Internal error: Correction factor for reference voltage missing in the OTP
40	Warning: Ballast resistor thermally overloaded
46	Interlock error: Bit 3 in $60FD_h$ is set to "0", the motor may not start

952 Fault Situation Counter

Function

The parameter specifies the number of fault situations since the last reset. Set this parameter to 0 to delete the the complete fault buffer.

Object description

Index	$03B8_h$
Object name	Fault Situation Counter
Object Code	VARIABLE

Data type	UNSIGNED16
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

A fault situation consists of up to 8 faults, where each falut is defined by its 945 Fault Code and 947 Fault Number.

964 Drive Unit Identification

Function

Contains the device identification parameters.

Object description

Index	$03C4_h$
Object name	Drive Unit Identification
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	05_h

Subindex	01_h
Name	Manufacturer
Data type	UNSIGNED16
Access	read / write

PDO mapping	no
Allowed values	
Preset value	0478_h

Subindex	02_h
Name	Drive Unit Type
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	03_h
Name	Version (Software)
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	04_h
Name	Firmware Date (year)
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	05_h
Name	Firmware Date (day/month)
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

965 Profile Identification Number

Function

This parameter contains the supported PROFIdrive version. Eg. 42 means version 4.2.

Object description

Index	$03C5_h$

Object name	Profile Identification Number
Object Code	VARIABLE
Data type	OCTET_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v2139-B1020888
Change history	

967 Control Word 1 (STW1)

Function

Controls the state machine. The function depends on the PROFIdrive operating mode.

Object description

Index	$03C7_h$
Object name	Control Word 1 (STW1)
Object Code	VARIABLE
Data type	V2
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

968 Status Word 1 (ZSW1)

Function

Shows the state of state machine. The function depends on the PROFIdrive operating mode.

Object description

Index	$03C8_h$
Object name	Status Word 1 (ZSW1)
Object Code	VARIABLE
Data type	V2
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888

Change history	

970 Load Parameter Set

Function

With this parameter you can reset all objects or one *category* of saved objects to the factory settings. You can find the categories in the chapter Saving objects.

Object description

Index	$03CA_h$
Object name	Load Parameter Set
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

In order to reset the category "application" for example, swrite here the value "3".

When the procedure has ended, the parameter is reset to "0".

971 Transfer Into A Nonvolatile Memory

Function

With this parameter you can save all objects or one *category* of objects. You can find the categories in the chapter Saving objects.

Object description

Index	$03CB_h$
Object name	Transfer Into A Nonvolatile Memory
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

Description

In order to save the category "application" for example, swrite here the value "3".

When the procedure has ended, the parameter is reset to "0".

972 Drive Reset

Function

Enter the value "1" here to reboot the firmware.

Object description

Index	$03CC_h$
Object name	Drive Reset
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2139-B1020888
Change history	

974 Base Mode Parameter Access Identification

Function

This parameter contains the settings for the parameter access.

Object description

Index	$03CE_h$
Object name	Base Mode Parameter Access Identification
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8

Access	read only
PDO mapping	no
Allowed values	
Preset value	03_h

Subindex	01_h
Name	Max Block Length
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$00F0_h$

Subindex	02_h
Name	Max Number Of Parameter Requests Per Multi-parameter Request
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	03_h
Name	Max Latency Per Request (n × 10 ms)
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

975 Drive Object Identification

Object description

Index	$03CF_h$
Object name	Drive Object Identification
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2213-B1037481
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	08_h

Subindex	01_h
Name	Manufacturer
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0478_h

Subindex	02_h
Name	Drive Object Type
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	03_h
Name	Version (Software)
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	04_h
Name	Firmware Date (year)
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	05_h
Name	Firmware Date (day/month)

Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	06_h
Name	Drive Object Type Class
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

Subindex	07_h
Name	Drive Object Type Sub-Class
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0005_h

Subindex	08_h
Name	Drive Object ID
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h

980 Number List Of Defined Parameter

Function

All parameters of the PROFIdrive Object Dictionary are listed here.

Object description

Index	$03D4_h$
Object name	Number List Of Defined Parameter
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	

Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	$3F_h$

60000 Velocity Reference Value

Function

Reference for all velocity values in thePROFIdrive Object Dictionary. Specified in rpm.

Object description

Index	$EA60_h$
Object name	Velocity Reference Value
Object Code	VARIABLE
Data type	REAL32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	3000.0f
Firmware version	FIR-v2139-B1020888
Change history	

61000 Name Of Station

Function

This parameter contains the *Name of Station* for the PROFINET Interface.

Object description

Index	$EE48_h$
Object name	Name Of Station
Object Code	VARIABLE
Data type	OCTET_STRING
Savable	no
Access	read / write
PDO mapping	no

Allowed values	
Preset value	0
Firmware version	FIR-v2139-B1020888
Change history	

61001 Ip Of Station

Object description

Index	$EE49_h$
Object name	Ip Of Station
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v2417-B1058532
Change history	

61003 Default Gateway Of Station

Object description

Index	$EE4B_h$
Object name	Default Gateway Of Station
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v2417-B1058532
Change history	

61004 Subnet Mask Of Station

Object description

Index	$EE4C_h$
Object name	Subnet Mask Of Station
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v2417-B1058532
Change history	

6 Commissioning

Described in this chapter is how you establish communication with the controller and set the necessary parameters to make the motor ready for operation. You can configure the controller via USB or PROFINET.

The *Plug & Drive Studio 3* software offers you an option for performing the configuration and adapting the controller to the connected motor. You can find further information in document *Plug & Drive Studio: User Manual* at us.nanotec.com.

CAUTION

The loss of the safety function due to incorrect wiring may lead to injuries!

Incorrect wiring or the use of unsuitable external components may lead to the loss of the safety function. This could result in injuries.

► Only use components that correspond to the safety category of the application.

► Check the electrical installation (wiring, pin assignment) and validate the STO function prior to the initial commissioning and after every intervention in the wiring and each time components/equipment are replaced.

► Do not bypass the STO function. If the wiring for the initial commissioning does not correspond to the required safety category of the application, remove it immediately after the initial commissioning.

CAUTION

The loss of the safety function due to electromagnetic interference may lead to injuries!

External interference may affect and result in the loss of the safety function.

► Observe the maximum permissible cable length of 30 m for all STO signals. Longer cables reduce the interference immunity (EMC) and require additional interference-suppression and protection measures.

► Use shielded cables for the STO signals.

► Lay supply, signal and control cables physically separate from one another.

CAUTION

Injuries resulting from unexpected and unintended movements of the drive during installation and maintenance work!

If the STO function is missing or not activated, the drive may start unexpectedly.

► Switch off the power supply before beginning the work.

► Secure all power supplies against accidentally being switched back on again.

NOTICE

EMC: Current-carrying cables – particularly around supply and motor cables – produce electromagnetic alternating fields. These can interfere with the motor and other devices.

Suitable measures may be:

► Use shielded cables and earth the cable shielding on both ends over a short distance.

► Keep power supply and motor cables as short as possible.

► Use cables with cores in twisted pairs.

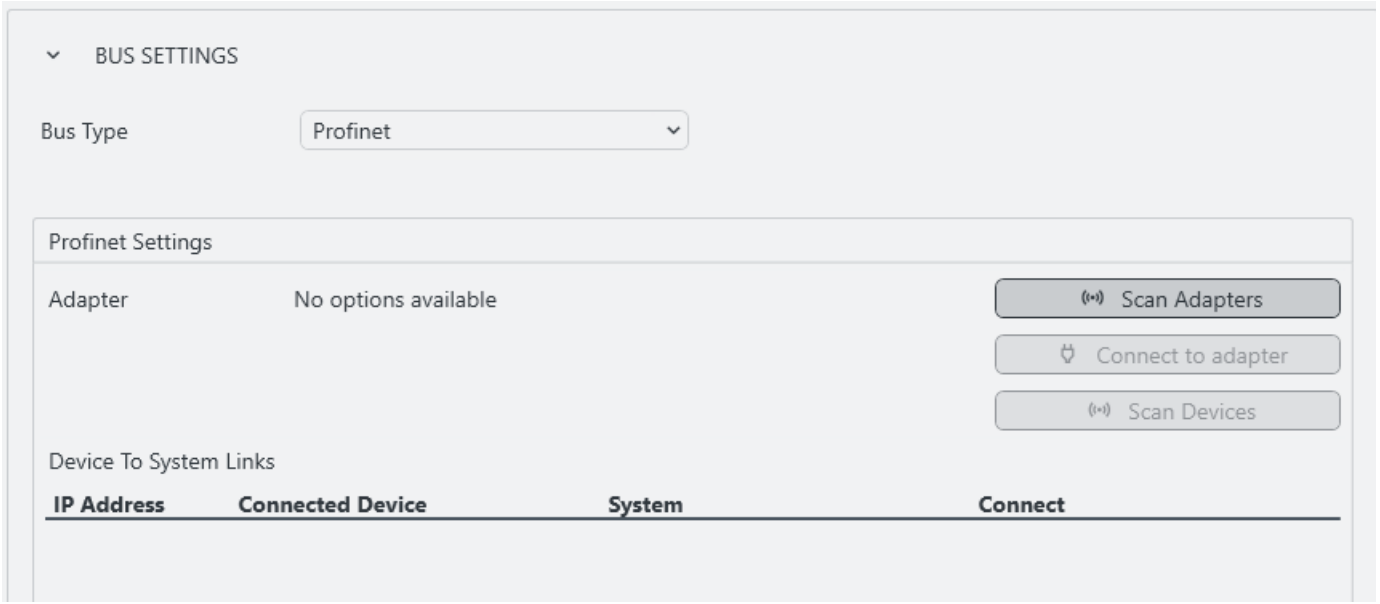
► Earth motor housing with large contact area over a short distance.

► Lay supply, motor and control cables separately.

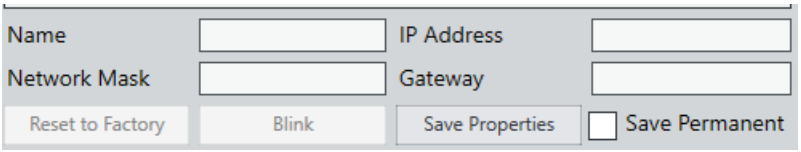
6.1 PROFINET settings

The device is defined in the PROFINET network by its station name (61000 Name Of Station). You can change and save the settings with *Plug & Drive Studio 3* via Ethernet (*PROFINET DCP*):

1. In the project, select the *Bus Type Profinet* and scan for *Adapters* and *Devices*, connect to the desired device.



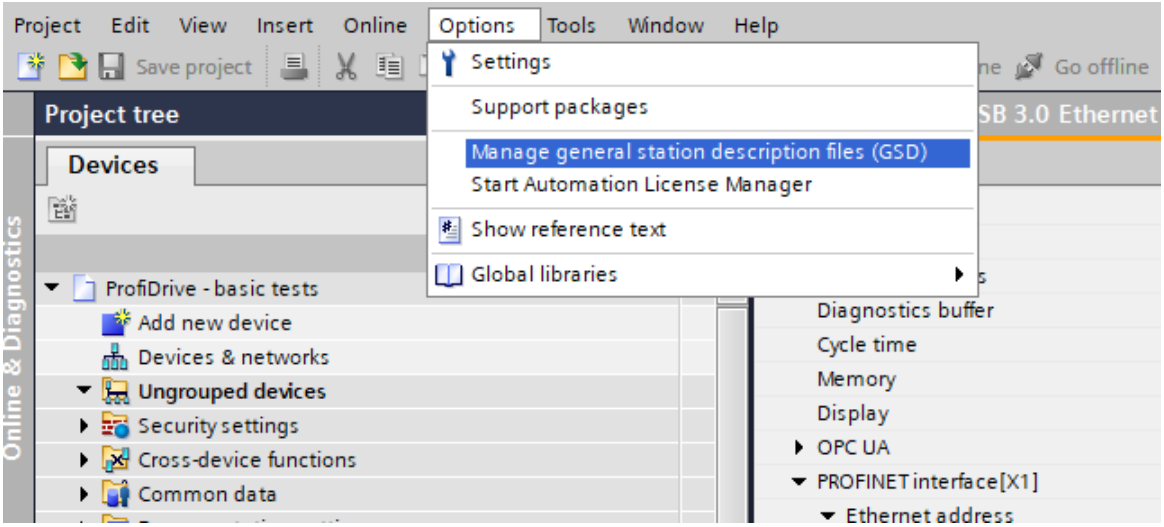
2. If needed, change the settings and save.



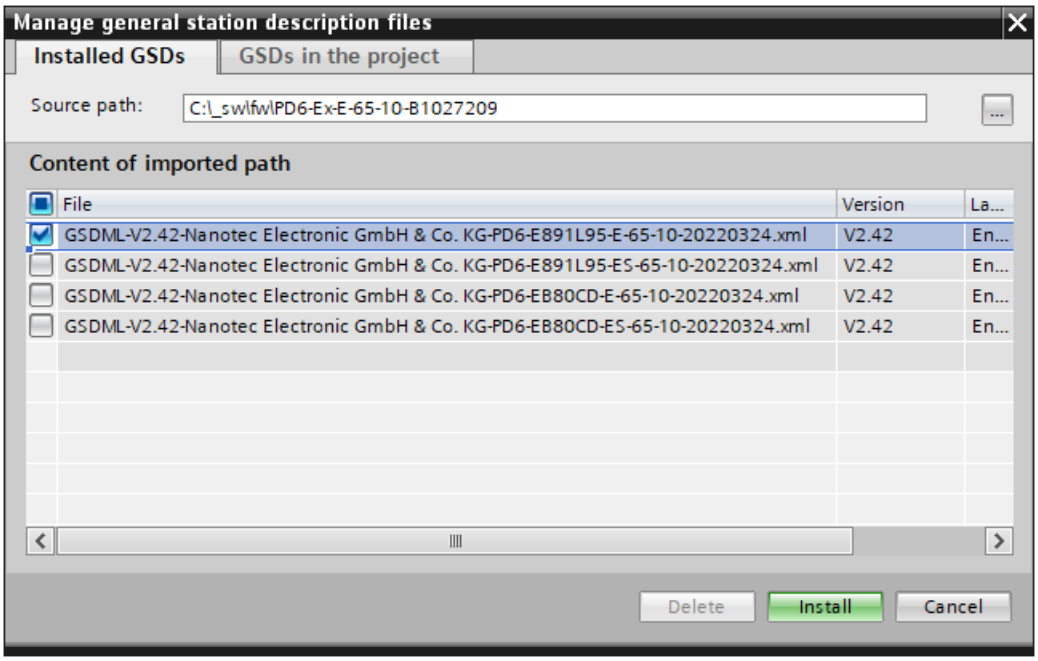
6.2 First commissioning in the *TIA Portal*

1. Obtain the *GSD file* from the product website on nanotec.com or from the Nanotec support.

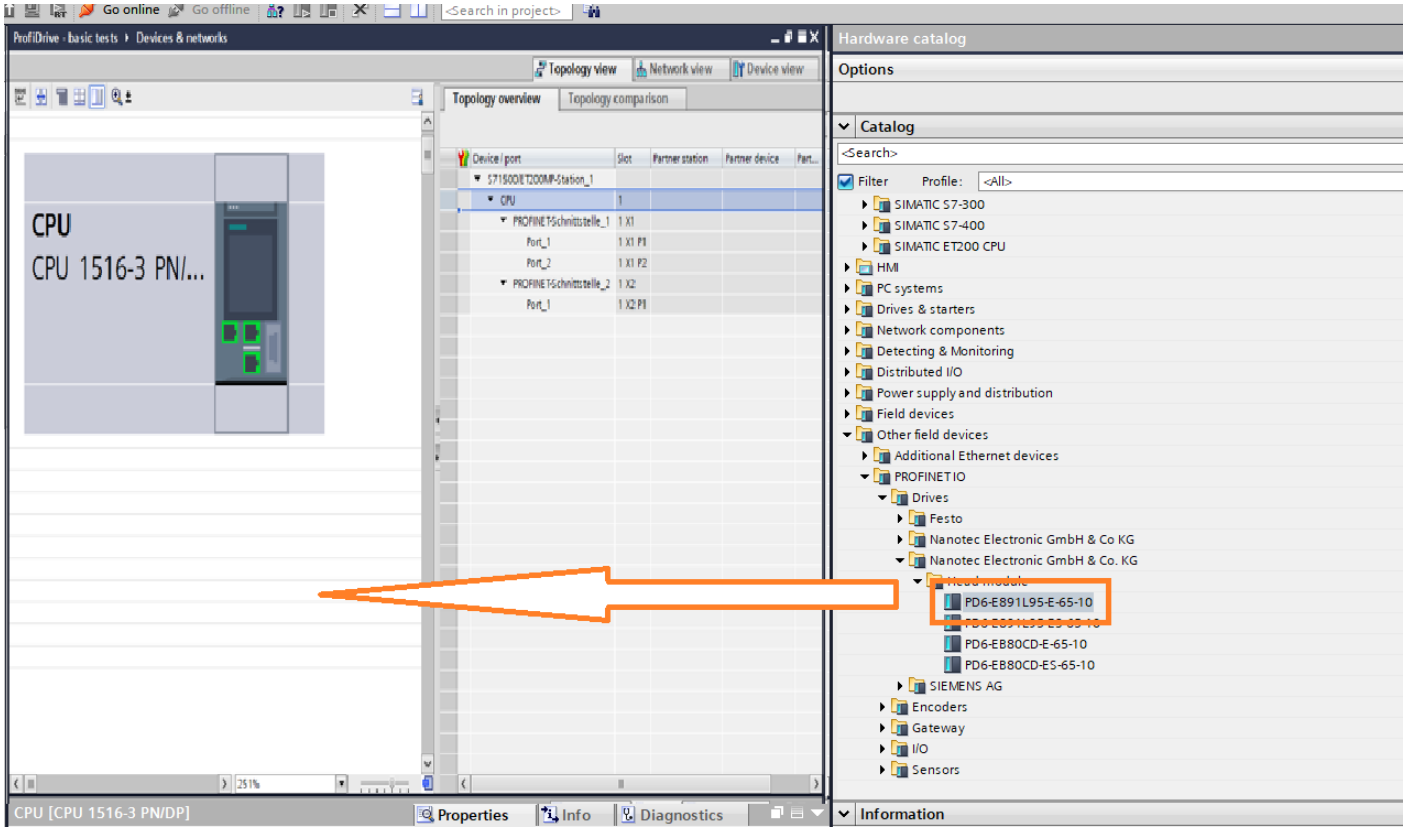
2. Select *Options → Manage general station description files (GSD)*.



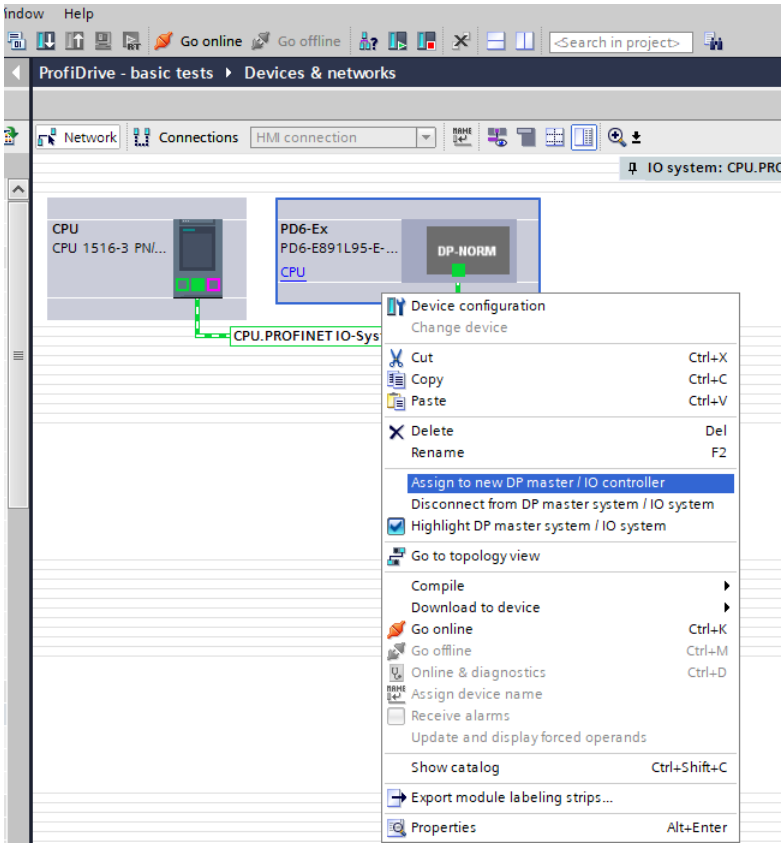
3. Load the *GSD file* that corresponds exactly to the part number.



4. Select in the *hardware catalog* your product and add it to your network via *drag & drop*.

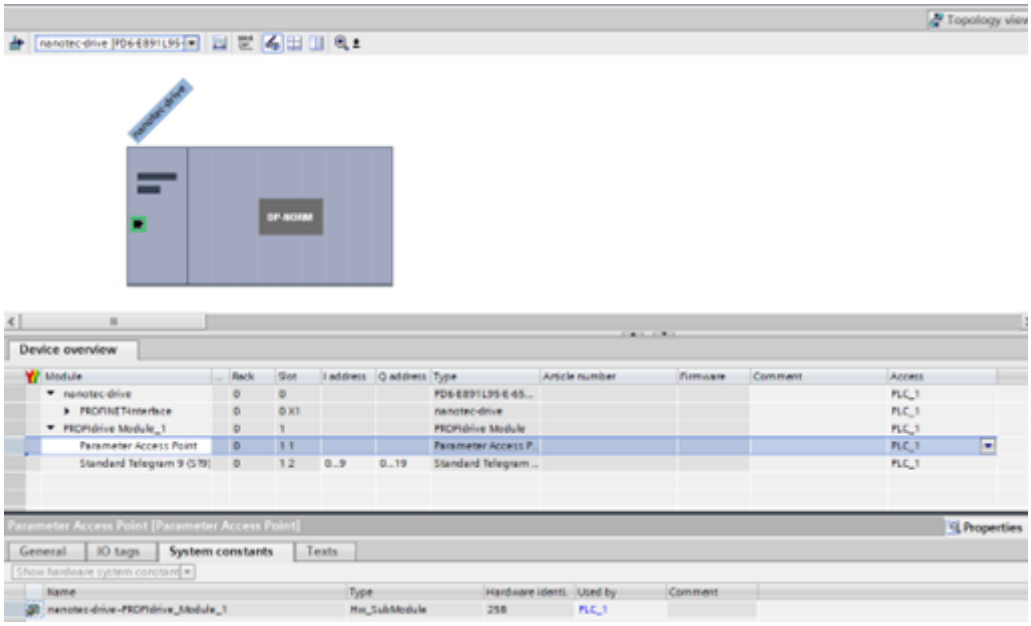


5. Connect the ports according to the cabling and assign the Nanotec controller to the PLC.

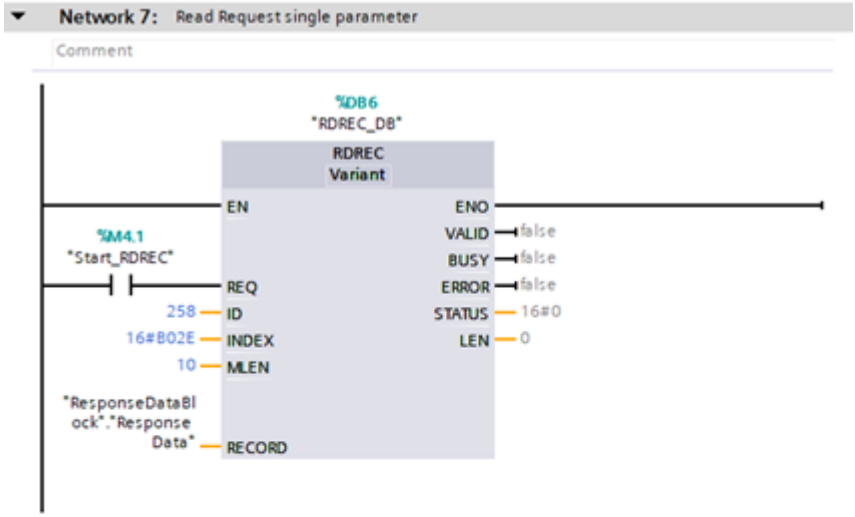


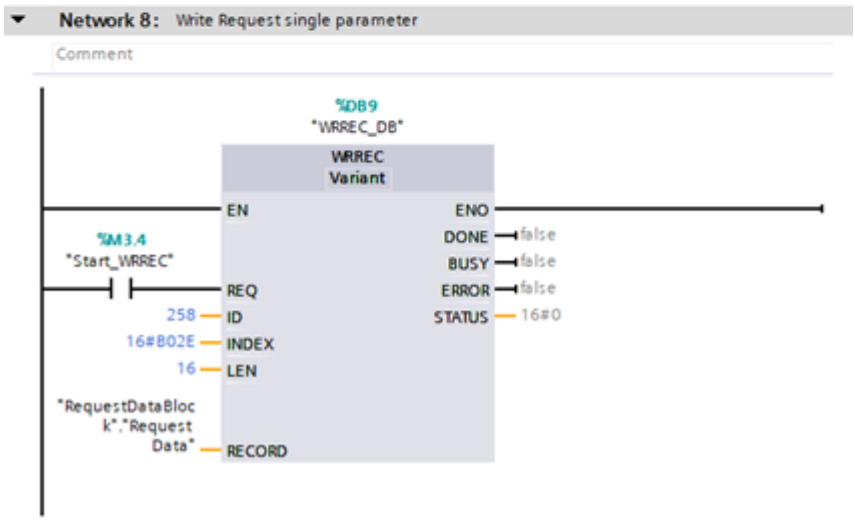
To access any object or parameter in the device, we can use the Base Mode Parameter Access. To do that you need to use a write record and a read record data block, which both use the index 0xB02E. The hardware ID is the ID of the Parameter Access Point of your device.

You can send/receive IO-Data cyclically via the Telegrams or read/write acyclically via the *Parameter Access Point*. For this you need to use a write record and a read record data block, which both use the index 0xB02E. The hardware ID is the ID of the Parameter Access Point of your device.



The relevant data blocks should look like this:





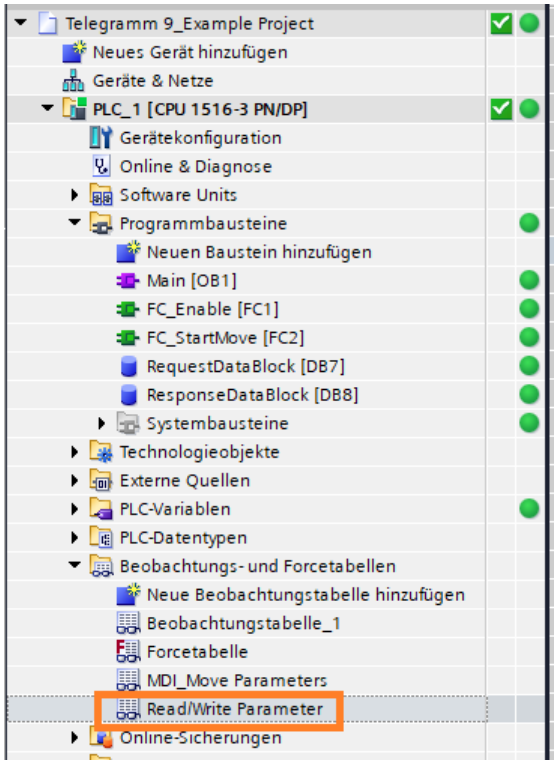
ResponseDataBlock

	Name	Data type	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint	Supervis...	Comment
1	Static									
2	Response Data	Struct								
3	Request reference ...	Byte	16#0							
4	response ID	Byte	16#0							
5	DOID mirrored	Byte	16#0							
6	no. of parameters	Byte	16#0							
7	format parameter	Byte	16#0							
8	no. of values	Byte	16#0							
9	parameter number	DWord	16#0							

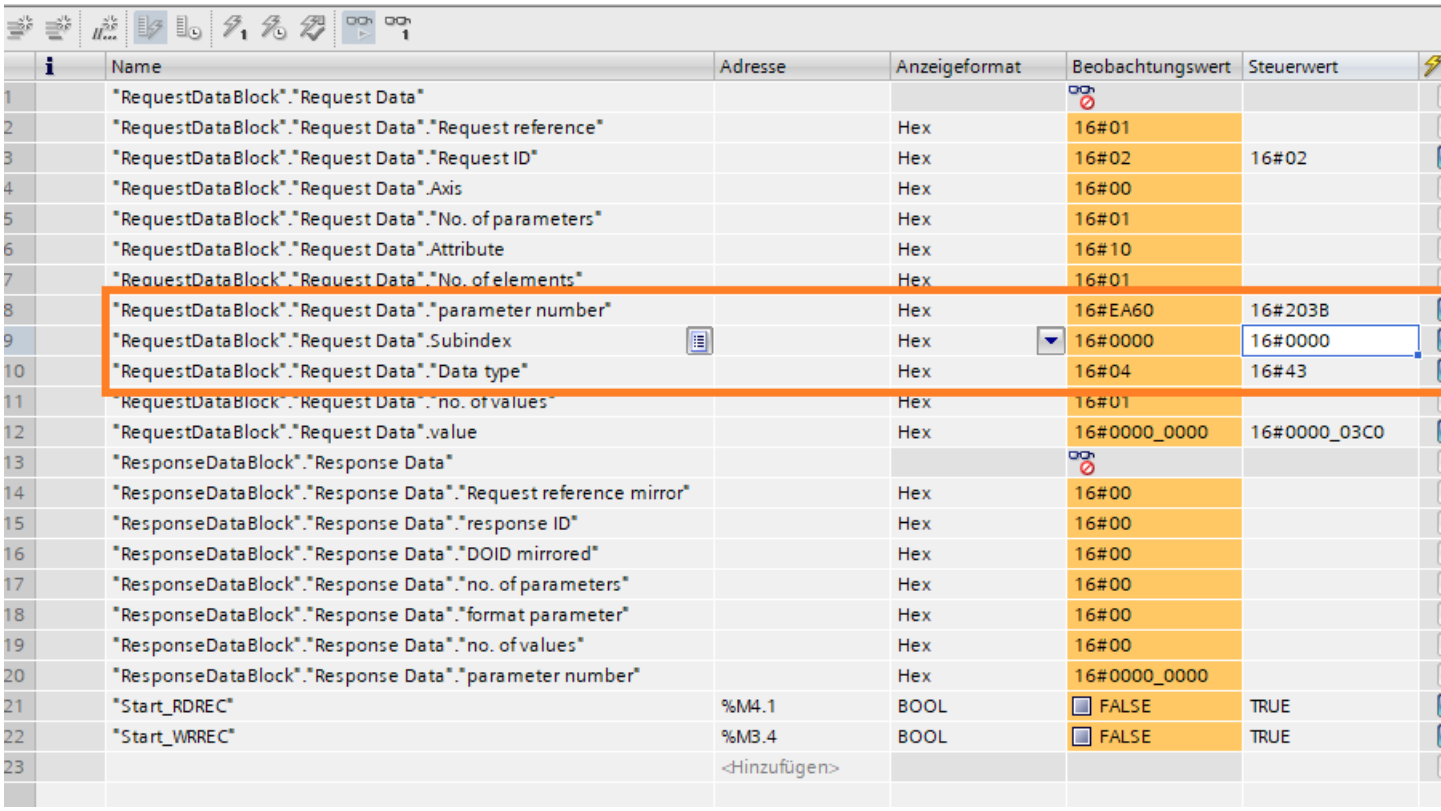
RequestDataBlock

	Name	Data type	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint	Supervis...	Commen
1	Static									
2	Request Data	Struct								
3	Request reference	Byte	16#01							
4	Request ID	Byte	16#02							
5	Axis	Byte	16#0							
6	No. of parameters	Byte	16#01							
7	Attribute	Byte	16#10							
8	No. of elements	Byte	16#01							
9	parameter number	Word	16#EA60							
10	Subindex	Word	16#00							
11	Data type	Byte	16#04							
12	no. of values	Byte	16#01							
13	value	DInt	0							

To read/write single parameters, use the *Watch and Force Table*:



Following variables are relevant in the process:



	Name	Adresse	Anzeigeformat	Beobachtungswert	Steuerwert
1	"RequestDataBlock"."Request Data"				
2	"RequestDataBlock"."Request Data"."Request reference"		Hex	16#01	
3	"RequestDataBlock"."Request Data"."Request ID"		Hex	16#02	16#02
4	"RequestDataBlock"."Request Data".Axis		Hex	16#00	
5	"RequestDataBlock"."Request Data"."No. of parameters"		Hex	16#01	
6	"RequestDataBlock"."Request Data".Attribute		Hex	16#10	
7	"RequestDataBlock"."Request Data"."No. of elements"		Hex	16#01	
8	"RequestDataBlock"."Request Data"."parameter number"		Hex	16#EA60	16#203B
9	"RequestDataBlock"."Request Data".Subindex		Hex	16#0000	16#0000
10	"RequestDataBlock"."Request Data"."Data type"		Hex	16#04	16#43
11	"RequestDataBlock"."Request Data"."no. of values"		Hex	16#01	
12	"RequestDataBlock"."Request Data".value		Hex	16#0000_0000	16#0000_03C0
13	"ResponseDataBlock"."Response Data"				
14	"ResponseDataBlock"."Response Data"."Request reference mirror"		Hex	16#00	
15	"ResponseDataBlock"."Response Data"."response ID"		Hex	16#00	
16	"ResponseDataBlock"."Response Data"."DOID mirrored"		Hex	16#00	
17	"ResponseDataBlock"."Response Data"."no. of parameters"		Hex	16#00	
18	"ResponseDataBlock"."Response Data"."format parameter"		Hex	16#00	
19	"ResponseDataBlock"."Response Data"."no. of values"		Hex	16#00	
20	"ResponseDataBlock"."Response Data"."parameter number"		Hex	16#0000_0000	
21	"Start_RDREC"	%M4.1	BOOL	FALSE	TRUE
22	"Start_WRREC"	%M3.4	BOOL	FALSE	TRUE
23		<Hinzufügen>			

- *Parameter number*: here you enter the object index.
- *Subindex*: here you enter the object subindex. For objects with multiple subindices, the value "0" corresponds to subindex 1.
- *Data type*: here you enter the object data type.

NOTICE

To avoid an overload of the bus and the controller, do not read/write single parameters while IO-data are transferred via the telegrams. werden.

6.3 Configuration via USB

6.3.1 General

The following options are available for configuring the controller via USB:

Configuration file

This file can be saved to the controller via the USB connection. For further information, read chapters USB connection and Configuration file.

NanoJ program

This program can be programmed, compiled and then transferred to the controller with *NanoJ* via USB. For further information, read chapters NanoJ program and Programming with NanoJ.

After connecting to a voltage supply, the controller reads out the configuration in the following order:

1. The configuration file is read out and processed.
2. The NanoJ program is started.

6.3.2 USB connection

NOTICE

Damage to the product and/or external hardware caused by differences in potential at the USB.

Connecting the USB cable while the electronics are being supplied (hot plugging) may result in damage.

► Connect USB before switching on the supply voltage.

► If possible, equalize differences in potential between PC and product or use USB isolator.

► First connect the USB cable to the product, then to the PC.

If the controller is connected to a PC via a USB cable, an MTP device with the exact *device name* of the product variant is created in the Windows file explorer that contains a data carrier.

Up to three files are displayed, the configuration file (`cfg*.txt`), the firmware (`*.fw`) and the *NanoJ program* (`nanoj*.usr`), which is stored internally immediately after restarting the controller and is no longer displayed.

You can thereby store the configuration file or the *NanoJ program* on the controller. The voltage supply of the controller must also be connected during USB operation.

NOTICE

- Only use a standard Micro USB cable, . Never use a USB cable that manufacturers of mobile phones include with their products. These USB cables could have a different plug shape or pin assignment.
- Do not save any files on the controller other than those listed below:

  1. `cfg*.txt`
  2. `nanoj*.usr`
  3. `reset.txt`

  Other files are not accepted by the controller.

PowerShell scripts

In the download area of the product website at nanotec.com, you can find file *mtp.ps1* with examples for the Windows PowerShell console. Based on the exact *device name* (see 1008_h), you can use this to:

- List all stored files:
  ```
  .\mtp.ps1 -Action list -DeviceName N6-1-1-1
  ```
- Copy a file from the current script folder to the device:
  ```
  .\mtp.ps1 -Action copy -DeviceName N6-1-1-1 -FileName cfg_Example.txt
  ```
- Delete a file:
  ```
  .\mtp.ps1 -Action delete -DeviceName N6-1-1-1 -FileName cfg_Example.txt
  ```

MTP in Linux

Nanotec recommends the following: MTP Tools. If the *GVfs* often included in Linux distributions is already installed, uninstall it first:

```
sudo apt remove gvfs
```

Then install *MPT Tools* and *libmtp* and restart:

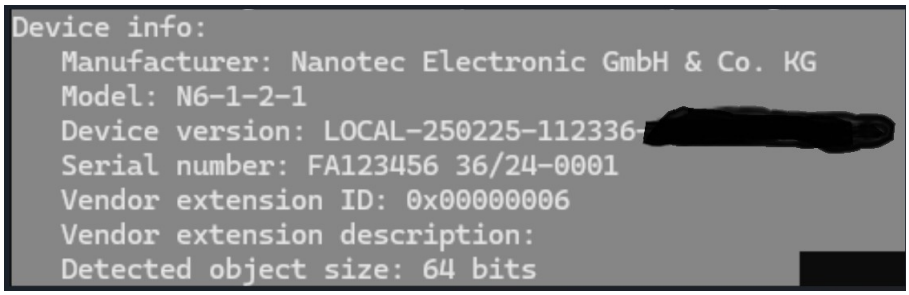
```
sudo apt-get install mtp-tools
sudo apt-get install libmtp-runtime
```

```
reboot
```

After connecting the USB, check whether the device is detected:

```
mtp-detect
```

The device responds to this with its properties (manufacturer, product name, serial number, etc.), similar to the following figure.



You can now:

- List all stored files with their ID:
  `mtp-files`
- Copy a file from the current script folder to the device (the name must be identical):
  `mtp-sendfile cfg_Out.txt cfg_Out.txt`
- Copy a file from the device (file ID listed as with *mtp-files*):
  `mtp-getfile 1072922872 cfg_Or.txt`
- Delete a file:
  `mtp-delfile -f cfg_Example.txt`

6.3.3 Configuration file

6.3.3.1 General

The `cfg.txt` configuration file is used to preset values for the object dictionary to a certain value during startup. This file uses a special syntax to make accessing the objects of the object dictionary as easy as possible. The controller evaluates all assignments in the file from top to bottom.

NOTICE

If you delete the configuration file, the controller recreates the file (without content) on the next restart.

6.3.3.2 Reading and writing the file

How to access the file:

1. Connect the controller to your PC using the USB cable.
2. Connect and switch on the voltage supply.
3. After the PC has detected the device as a removable storage device, navigate in the Explorer to the directory of the controller. File `cfg*.txt` is stored there.
4. Open this file with a simple text editor, such as Notepad or Vi. Do not use any programs that use markup (LibreOffice or similar).

After you have made changes to the file, proceed as follows to apply the changes through a restart:

1. Save the file if you have not yet already done so.
2. Disconnect the voltage supply from the controller for approx. 1 second until the power LEDs stop flashing.
3. Reconnect the voltage supply. When the controller is now restarted, the values in the configuration file are read out and applied.

TIP

To restart the controller, you can also copy an empty `reset.txt` file to the controller. This restarts the controller. The `reset.txt` file is deleted on the next restart.

6.3.3.3 Structure of the configuration file

Comments

Lines that begin with a semicolon are ignored by the controller.

Example

```
; This is a comment line
```

Assignments

NOTICE

Before setting a value, determine its data type (see chapter Description of the object dictionary)! The controller does not validate entries for logical errors!

Values in the object dictionary can be set with the following syntax:

```
<Index>:<Subindex>=<Value>
```

<Index>
This value corresponds to the index of the object and is interpreted as a hexadecimal number. The value must always be specified with four digits.

<Subindex>
This value corresponds to the subindex of the object and is interpreted as a hexadecimal number. The value must always be specified with two digits and can be omitted if the subindex is 00_h.

<Value>
The value that is to be written in the object is interpreted as a hexadecimal number. Hexadecimal numbers are to be prefixed with "`0x`". For float values, add an "`f`" to the end of the number.

You can also set individual bits:

Set bit

```
3202:00.01=1
```

Reset bit

```
3202:00.01=0
```

Bitwise OR

```
3202:00|=0x01
```

Bitwise AND

```
3202:00&=0x01
```

Example

Set object 6075_h:00 (rated current) to the value "600" (mA):

```
6075:00=600
```

Set object 3202_h:00 to the value "1" (activate *closed-loop* mode):

```
3202:00=1
```

or only set bit 0

```
3202:00.00=1
```

Set object $EA60_h$:00 (REAL32) to the value "3000_f":

```
EA60:00=3000.0f
```

NOTICE

- There must be no blank characters to the left and right of the equal sign. The following assignments are not correct:
  ```
  6040:00 =5
  6040:00= 5
  6040:00 = 5
  ```
- The number of places must not be changed. The index must be four characters long and the subindex two characters long. The following assignments are not correct:
  ```
  6040:0=6
  6040=6
  ```
- Blank spaces at the start of the line are not permitted.

6.3.4 NanoJ program

A *NanoJ program* can be executed on the controller. To load and start a program on the controller, proceed as follows:

1. Write and compile your program as described in chapter Programming with NanoJ.
2. Connect the voltage supply to the controller and switch on the voltage supply.
3. Connect the controller to your PC using the USB cable.
4. After the PC has detected the device as a removable storage device, open an Explorer window and delete file `nanoj*.usr` on the controller.
5. Navigate in the Explorer to the directory with your program. The compiled file has the same name as the source code file, only with file extension `.usr`. Rename this file `nanoj*.usr`.
6. Copy file `nanoj*.usr` to the controller.

7. Disconnect the voltage supply from the controller for approx. 1 second until the power LEDs stop flashing.
8. Reconnect the voltage supply. When the controller now starts, the new *NanoJ program* is read in and started.

TIP

To restart the controller, you can also copy an empty `reset.txt` file to the controller. This restarts the controller. The `reset.txt` file is deleted on the next restart.

NOTICE

- The *NanoJ program* on the controller must have file name `nanoj*.usr`.

6.4 Setting the motor data

Prior to commissioning, the motor controller requires a number of values from the motor data sheet.

NOTICE

The controller offers no protection for the motor against overload or overtemperature. For critical applications, perform an endurance test in the actual environment and, if necessary, ensure sufficient cooling of the motor.

- Number of pole pairs: Object 2030_h:00_h (pole pair count) The number of motor pole pairs is to be entered here. With a stepper motor, the number of pole pairs is calculated using the step angle, e.g., 1.8° = 50 pole pairs, 0.9° = 100 pole pairs (see step angle in motor data sheet). With BLDC motors, the number of pole pairs is specified directly in the motor data sheet.
- Object 6075_h:00_h: rated current of the motor in mA (see motor data sheet
- Object 6073_h:00_h: maximum current (for a stepper motor, generally corresponds to the rated current, bipolar) in tenths of a percent of the set rated current (see motor data sheet). Factory settings: "1000", which corresponds to 100% of the value in 6075_h.
- Object **3219_h**:01_h Maximum duration of the maximum current (6073_h) in ms (for initial commissioning, Nanotec recommends a value of 100 ms; this value is to be adapted later to the specific application).
- Setting the motor type:
  - Stepper motor:
    - Object 3202_h (Motor Drive Submode Select): Set bit 6 to "0" for stepper motor and use bit 0 to select between open- and closed-loop: value 0_h or 1_h.See also chapter Commissioning *open-loop*.
    - Object **3219_h**:03_h (Open Loop Idle State Current): Specify the root mean square in tenths of a percent to which the rated current is to be reduced if current reduction is activated in *open-loop*.
  - BLDC motor:
    - Object 3202_h (Motor Drive Submode Select): Bit 6 for BLDC, bit 0 for the recommended *closed-loop*: 00000041_h
- Motor with encoder without index: You must set the encoder parameters after the Auto setup, see chapter Configuring the sensors.
- Motor with brake: Object 3202_h:00_h (Motor Drive Submode Select): The brake control is activated for the initial commissioning. Depending on the specific application, this configuration can be deactivated later if necessary. One of the following values is to be entered depending on the motor type:
  - Stepper motor, brake control activated: 00000004_h
  - BLDC motor, brake control activated, *closed-loop*: 00000045_h

NOTICE

Due to the sine commutation and the sinusoidal current flow, the current of a motor winding can achieve an alternating current value that is briefly greater (by max. √2 times) than the set current.

At especially slow speeds or while at a standstill with full load, one of the windings can therefore be supplied with overcurrent for a longer period of time. Take this into account when dimensioning the motor and select a motor with larger torque reserve if necessary if required by the application.

6.5 Connecting the motor

After setting the motor parameters, see Setting the motor data, connect the motor and, if applicable, the present sensors (encoders / Hall sensors) and the brake.

NOTICE

Damage to the electronics if motor is connected incorrectly!

► Observe the PIN assignment in chapter *Pin assignment* and the motor data sheet.

- Connect the motor:
  - to connection X1 – motor connection
- Connect encoders / Hall sensors:
  - to connection X6 – incremental encoder/Hall sensors
  - or to X5 – SSI encoder
- Connect the brake:
  - to connection X4 – inputs and outputs

  How the automatic brake control can be activated is described in chapter Automatic brake control.

6.6 Auto setup

To determine a number of parameters related to the motor and the connected sensors (encoders/Hall sensors), you must perform an auto setup.

TIP

As long as the motor connected to the controller or the sensors for feedback (encoders/Hall sensors) are not changed, auto setup is only to be performed once during initial commissioning.

NOTICE

Note the following prerequisites for performing the auto setup:

► The motor must be load-free.

► The motor must not be touched.

► The motor must be able to turn freely in any direction.

► No NanoJ programs may be running (object 2300_h:00_h bit 0 = "0", see 2300h NanoJ Control).

TIP

Execution of the auto setup requires a relatively large amount of processor computing power. During the auto setup, this may result in fieldbuses not being operated in a timely manner.

6.6.1 Parameter determination

Auto setup determines various parameters of the connected motor and of the present sensors by means of multiple test runs and measurement runs. To a certain extent, the type and number of parameters are dependent on the respective motor configuration.

Parameter	All motors independent of the configuration
Motor type (stepper motor or BLDC motor)	✓
Winding resistance	✓
Winding inductance	✓
Interlinking flux	✓

NOTICE

It is not possible to determine the interlinking flux on motors whose windings have widely differing inductances. These motors are, therefore, not suitable for sensorless *closed-loop* operation.

Parameter	Motor without encoder	Motor with encoder and index	Motor with encoder without index
Encoder resolution	-	✓	---
Alignment (shifting of the electrical zero to the index)	-	✓	---

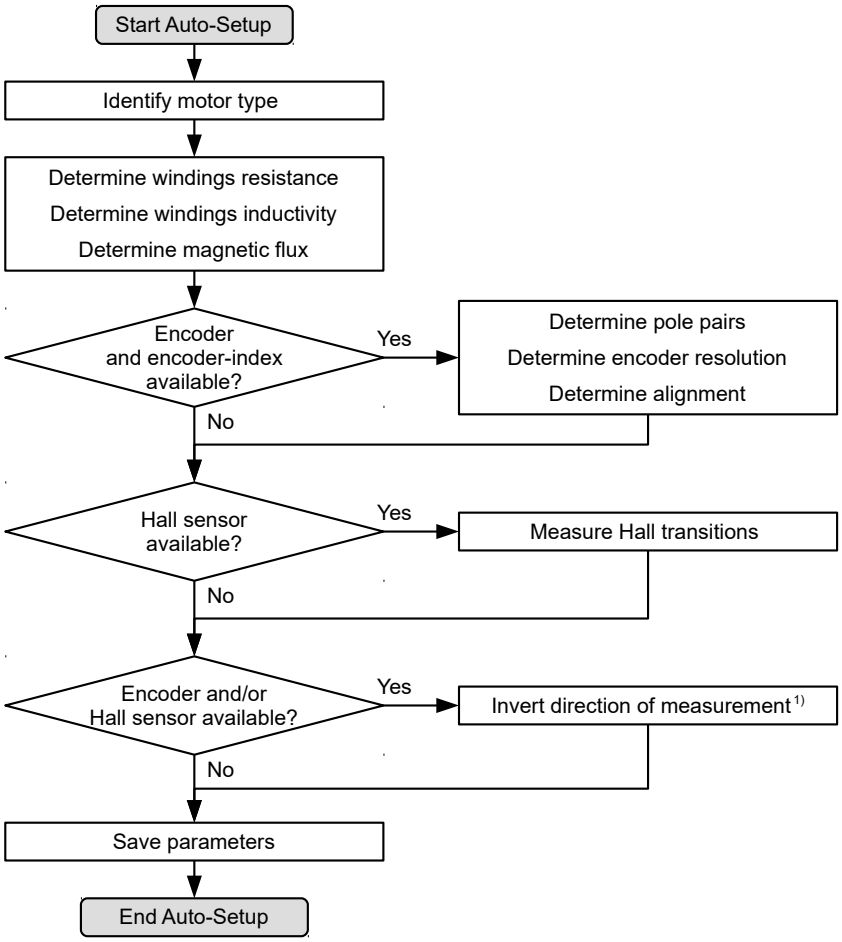
Parameter	Motor without Hall sensor	Motor with Hall sensor
Hall transitions	-	✓

6.6.2 Execution

Before performing the *auto setup*, make certain that you have correctly set the necessary parameters (see Setting the motor data).

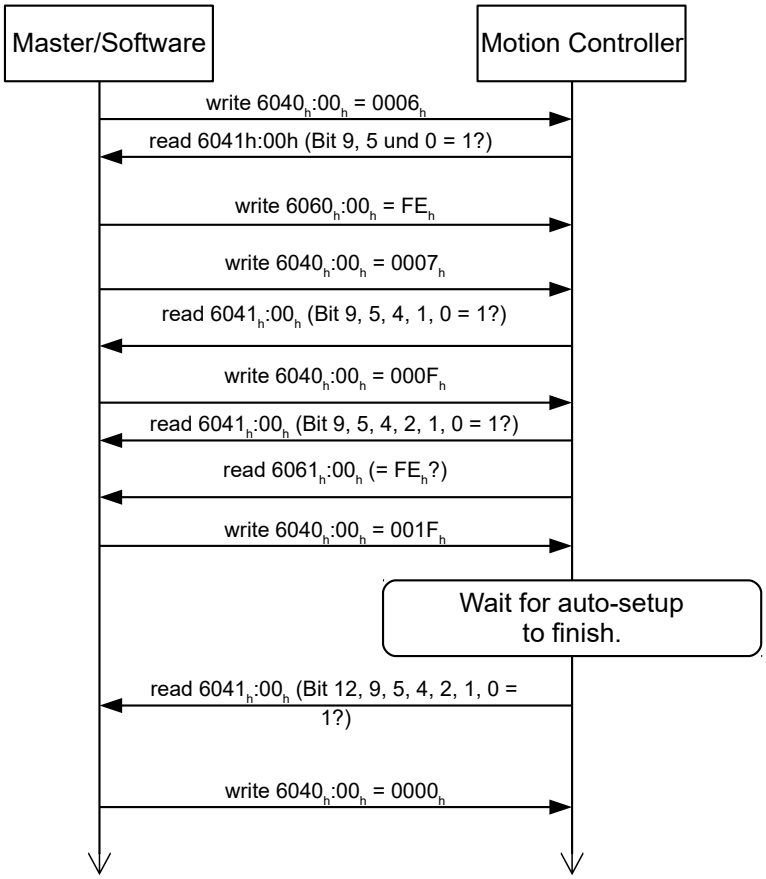
1. To preselect the *auto setup* operating mode, enter the value "-2" (="FE_h") in object 6060_h:00_h.
   The *power state machine* must now switch to the *Operation enabled* state, see CiA 402 Power State Machine.
2. Start *auto setup* by setting bit 4 *OMS* in object 6040_h:00_h (controlword).

   While the auto setup is running, the following tests and measurements are performed in succession:



1) To determine the values, the direction of the measurement method is reversed and edge detection re-evaluated.

Value 1 in bit 12 *OMS* in object 6041_h:00_h (statusword) indicates that the auto setup was completely executed and ended. In addition, bit 10 *TARG* in object 6041_h:00_h can be used to query whether (= "1") or not (= "0") an encoder index was found.



6.6.3 Parameter memory

After a successful *auto setup*, the determined parameter values are automatically taken over into the corresponding objects and stored with the storage mechanism, see Saving objects and 1010h Store Parameters. Categories *Motor* 1010_h:05_h and *Sensor* 1010_h:06_h are used.

CAUTION!

Uncontrolled motor movements!

After the auto setup, the internal coordinate system is no longer valid. Unforeseen reactions can result.

► Restart the device after an auto setup. Homing alone does not suffice.

6.7 Configuring the sensors

The parameters (configuration, alignment, etc.) of each feedback are determined by Auto setup and stored in the following objects:

Object	Feedback	Description
3380_h	Sensorless	Contains measurement and configuration values for sensorless control
3390_h	Hall sensor (digital)	contains configuration values for the Hall sensors
$33A0_h$	Incremental encoder 1	contains configuration values for the first incremental encoder

Object	Feedback	Description
33B0$_h$	SSI encoder 1	contains configuration values for the first SSI encoder

NOTICE

It is not possible to determine the resolution of encoders without index or with more than one index per motor revolution.

In this case, you must enter and store the parameters in the corresponding objects (see 3204$_h$, 60E6$_h$ and 60EB$_h$) (category *Sensor*, see Saving objects).

For external sensors that are not mounted directly on the motor shaft, you must set and store the gear ratio according to the constructive features (6091$_h$) and/or the feed constant (6092$_h$) (category *Application*).

Example

An encoder with a resolution of 2000 increments/mm was connected that is to be used in the field directly at the process for a high-precision position measurement. The constructive design was realized as follows:

Motor	Gearbox	Process	Encoder
Rotary	Rotary | Rotary	Rotary | Translational	Translational
1	i=4	Diameter 40 mm | 125.6637... mm/ revolution	2000 incr./mm (62831.85 incr. per motor revolution)

You must set the resolution, gear ratio and feed constant as follows:

Object	Value
60E6h Additional Position Encoder Resolution - Encoder Increments	1256637
60EBh Additional Position Encoder Resolution - Motor Revolutions	20
6091$_h$:01 (Motor Revolutions)	4
6091$_h$:02 (Shaft Revolutions)	1
6092$_h$:01 (Feed)	2513274 incr. (corresponds to 1256.637 mm)
6092$_h$:02 (Shaft Revolutions)	10

You must still set the unit for the position to millimeters or other unit of length, see chapter User-defined units.

In object 3203$_h$ you can set which of the present feedbacks the controller takes into account for each controller (current controller/commutation, velocity controller, position controller) in *closed-loop* or the determination of the actual position and actual speed in *open-loop*. See also chapter Closed-Loop and Assignment of the feedbacks to the control loops.

NOTICE

The value "0" in a subindex of the object 60E6$_h$ means that the respective feedback is not connected and is not used. Thus, it is possible, for Example, to switch off the sensorless function to save computing time. This can be helpful if a *NanoJ* program needs the computing time.

If a value is not equal to "0" in a subindex, the controller uses the corresponding sensor. In case of an error (signal not present, invalid configuration/state), the error bit is set in the statusword and an error code stored in object 1003h.

7 General concepts

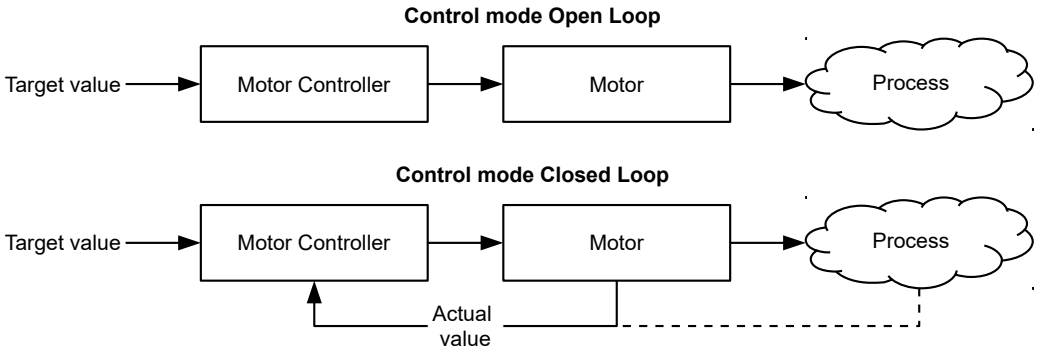
7.1 Control modes

7.1.1 General

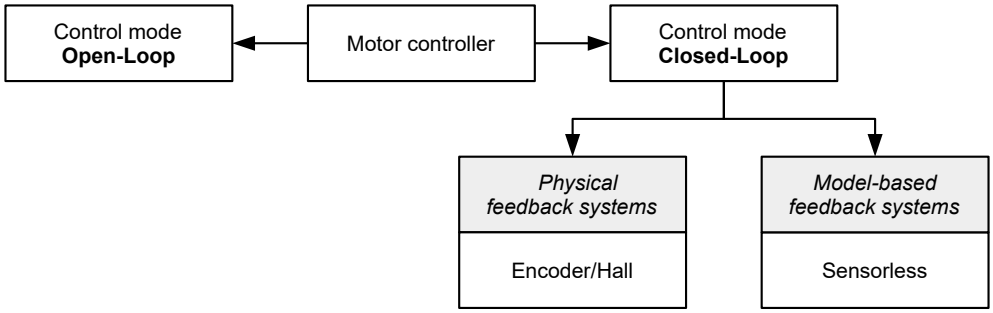
The control mode of systems without feedback is called *open-loop*, the mode with feedback is called *closed-loop*. In the *closed-loop* control mode, it is initially irrelevant whether the fed back signals come from the motor itself or from the influenced process.

For controllers with feedback, the measured control variable (actual value) is constantly compared with a set point (set value). In the event of deviations between these values, the controller readjusts according to the specified control parameters.

Pure controllers, on the other hand, have no feedback for the value that is to be regulated. The set point (set value) is only specified.



In addition to the physical feedback systems (e.g., via encoders or Hall sensors), model-based feedback systems, collectively referred to as *sensorless* systems, are also used. Both feedback systems can also be used in combination to further improve the control quality.



Summarized in the following are all possible combinations of control modes and feedback systems with respect to the motor technology. Support of the respective control mode and feedback is controller-specific and is described in chapters *Pin assignment* and CiA 402 operating modes and state machine.

Control mode	Stepper motor	BLDC motor
Open-Loop	yes	no
Closed-Loop	yes	yes

Feedback	Stepper motor	BLDC motor
Hall	no	yes
Encoder	yes	yes

Feedback	Stepper motor	BLDC motor
Sensorless	yes	yes

Various operating modes can be used depending on the control mode. The following list contains all the types of operation that are possible in the various control modes.

Operating mode	Control mode	
	Open-Loop	Closed-Loop
Profile Position	yes	yes
Profile Velocity	yes	yes
Profile Torque	no[1)]	yes
Homing	yes[2)]	yes
Interpolated Position Mode	yes[3)]	yes
Cyclic Synchronous Position	yes[3)]	yes
Cyclic Synchronous Velocity	yes[3)]	yes
Cyclic Synchronous Torque	no[1)]	yes
Clock-direction	yes	yes

1) The Profile Torque, Torque and Cyclic Synchronous Torque torque operating modes are not possible in the *open-loop* control mode due to a lack of feedback.

2) Exception: Homing on block is not possible due to a lack of feedback.

3) Because ramps and speeds in operating modes Cyclic Synchronous Position and Cyclic Synchronous Velocity follow from the specified points of the master, it is not normally possible to preselect these parameters and to ascertain whether a step loss can be excluded. It is therefore not advisable to use these operating modes in combination with *open-loop* control mode.

7.1.2 Open-Loop

7.1.2.1 Introduction

Open-loop mode is only used with stepper motors and is, by definition, a control mode without feedback. The field rotation in the stator is specified by the controller. The rotor directly follows the magnetic field rotation without step losses as long as no limit parameters, such as the maximum possible torque, are exceeded. Compared to *closed-loop*, no complex internal control processes are needed in the controller. As a result, the requirements on the controller hardware and the controller logic are very low. *Open-loop* mode is used primarily with price-sensitive applications and simple movement tasks.

Because, unlike *closed-loop*, there is no feedback for the current rotor position, no conclusion can be drawn on the counter torque being applied to the output side of the motor shaft. To compensate for any torque fluctuations that arise on the output shaft of the motor, in *open-loop* mode, the controller always supplies the maximum possible (e.g., specified by parameters) set current to the stator windings over the entire speed range. The high magnetic field strength thereby produced forces the rotor to assume the new steady state in a very short time. This torque is, however, opposite that of the inertia of the rotor and overall system. Under certain operating conditions, this combination is prone to resonances, comparable to a spring-mass system.

7.1.2.2 Commissioning

To use *open-loop* mode, the following settings are necessary:

- In object 2030_h (Pole Pair Count), enter the number of pole pairs (see motor data sheet: for a stepper motor with 2 phases, a step angle of 1.8° corresponds to 50 pole pairs and 0.9° corresponds to 100 pole pairs).
- In object 6075_h:00_h, enter the rated current of the motor in mA (see motor data sheet).

- In object 6073_h:00_h, enter the maximum current (for a stepper motor, generally corresponds to the rated current, bipolar) in tenths of a percent of the set rated current (see motor data sheet). Factory settings: "1000", which corresponds to 100% of the value in 6075_h. A value greater than "1000" is limited internally to "1000".
- In object 3202_h (Motor Drive Submode Select), set bit 0 (CL/OL) to the value "0".

Nanotec recommends the current reduction on motor standstill in order to reduce the power loss and heat build-up:

- In object 3219_h:02 (Open Loop Idle State Detection Time), the time in milliseconds is specified that the motor must be at a standstill (set value is checked) before current reduction is activated.
- In object 3219_h:03 (Open Loop Idle State Current), the root mean square is specified to which the rated current is to be reduced if current reduction is activated in *open-loop* and the motor is at a standstill.

7.1.2.3 Optimizations

Depending on the system, resonances may occur in *open-loop* mode; susceptibility to resonances is particularly high at low loads. Practical experience has shown that, depending on the application, various measures are effective for largely reducing resonances:

- Reduce or increase current, see objects 6073_h and 6075_h, respectively. An excessive torque reserve promotes resonances.
- Reduce or increase the operating voltage, taking into account the product-specific ranges (with sufficient torque reserve). The permissible operating voltage range can be found in the product data sheet.
- Adjustments to the acceleration, deceleration and/or target speed depending on the selected control mode:

  Profile Position operating mode

  Objects 6083_h (Profile Acceleration), 6084_h (Profile Deceleration) and 6081_h (Profile Velocity).

  Profile Velocity operating mode

  Objects 6083_h (Profile Acceleration), 6084_h (Profile Deceleration) and 6081_h (Profile Velocity).

  Homing operating mode

  Objects $609A_h$ (Homing Acceleration), 6099_h:01_h (Speed During Search For Switch) and 6099_h:02_h (Speed During Search For Zero).

  Interpolated Position Mode operating mode

  The acceleration and deceleration ramps can be influenced with the higher-level controller.

  Cyclic Synchronous Position operating mode

  The acceleration and deceleration ramps can be influenced via the external "position specification / time unit" targets.

  Cyclic Synchronous Velocity operating mode

  The acceleration and deceleration ramps can be influenced via the external "position specification / time unit" targets.

  Clock-direction operating mode

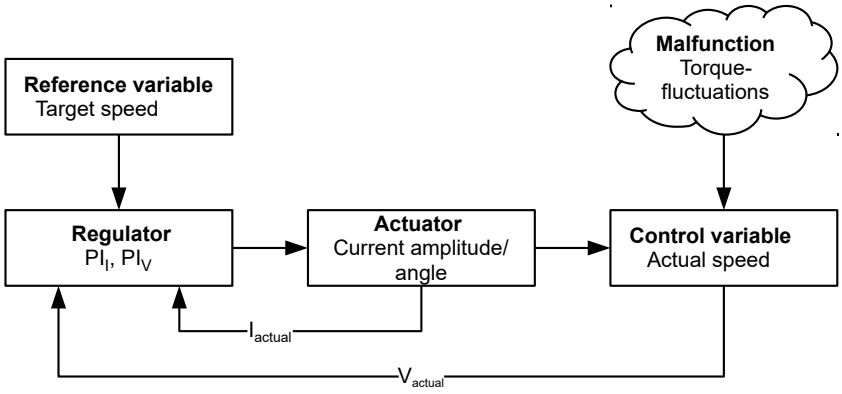
  Change of the step resolution via objects 2057_h (Clock Direction Multiplier) and 2058_h (Clock Direction Divider). Optimize acceleration / deceleration ramps by adjusting the pulse frequency to pass through the resonance range as quickly as possible.

7.1.3 Closed-Loop

7.1.3.1 Introduction

The *closed-loop* theory is based on the idea of a control loop. A disturbance acting on a system should be compensated for quickly and without lasting deviation to adjust the control variable back to the set point.

Closed loop using a speed control as an example:



PI_I = Proportional-integral current control loop
PI_V = Proportional-integral velocity control loop
I_{actual} = Actual current
V_{actual} = Actual speed

The *closed-loop* method is also referred to as "sine commutation via an encoder with field-oriented control". At the heart of *closed-loop* technology is the performance-adjusted current control as well as the feedback of the actual values of the process. Using sensor signals, the rotor orientation is recorded and sinusoidal phase currents generated in the motor windings. Vector control of the magnetic field ensures that the magnetic field of the stator is always perpendicular to that of the rotor and that the field strength corresponds precisely to the desired torque. The current thereby controlled in the windings provides a uniform motor force and results in an especially smooth-running motor that can be precisely regulated.

The feedback of the control variables necessary for *closed-loop* mode can be realized with various technologies. In addition to the physical feedback with encoders or Hall sensors, it is also possible to virtually record the motor parameters through a software-based model calculation. Physical variables, such as speed or back-EMF, can be reconstructed with the help of a so-called "observer" from the data of the current controller. With this sensorless technology, one has a "virtual rotary encoder", which – above a certain minimum speed – supplies the position and speed information with the same precision as a real optical or magnetic encoder.

All controllers from Nanotec that support *closed-loop* mode implement a field oriented control with sine commutated current control. Thus, the stepper motors and BLDC motor are controlled in the same way as a servo motor. With *closed-loop* mode, step angle errors can be compensated for during travel and load angle errors corrected within one full step.

7.1.3.2 Controller structure

The controller consists of three cascaded PI controllers (proportional-integral): the current controller (commutation), the velocity controller and the position controller.

The current controller is active in all operating modes. The velocity controller is as well with the sole exception of the "Real Torque" modes (torque mode without speed limiting if bit 5 in 3202_h is set to "1").

The position controller is active in the following operating modes:

- Profile Position
- Homing
- Interpolated Position Mode
- Cyclic Synchronous Position
- Clock-direction mode
- Profile Velocity/Cyclic Synchronous Velocity if bit 1 in 3202_h is set to "1"

Each controller consists of a proportional component with the *gain factor* K_p and an integral component with the *integrator time* T_i. The control variable (the output signal of the controller, which is the set point for the next controller) is limited by the maximum speed (position controller), the maximum current (velocity controller) or the maximum PWM signal (current controller), respectively.

Object	Name	Unit	Description
321A$_h$:01$_h$	Current controller Proportional Gain Kp for Iq	[mV/A]	Proportional component of torque-forming component
321A$_h$:02$_h$	Current controller Integrator Time Ti for Iq	[µs]	Integrator time of torque-forming component
321A$_h$:03$_h$	Current controller Proportional Gain Kp for Id	[mV/A]	Proportional component of field-forming component
321A$_h$:04$_h$	Current controller Integrator Time Ti for Id	[µs]	Integrator time of field-forming component
321B$_h$:01$_h$	Velocity controller Proportional Gain Kp	[mA/Hz]	Proportional component
321B$_h$:02$_h$	Velocity controller Integrator Time Ti	[µs]	Integrator time
321C$_h$:01$_h$	Position controller Proportional Gain Kp	[Hz] (Controller deviation in mech. revolutions per second)	Proportional component
321C$_h$:02$_h$	Position controller Integrator Time Ti	[µs]	Integrator time

The *gain factor* K_p has a direct influence on the current control variable: at the same deviation, the control variable is proportional to the gain factor.

Each controller also has an integral component that is determined by the *integrator time* (T_i). The smaller the integrator time, the faster the control variable increases. If the integrator time is 0, the integral component is internally set to "0" and the controller only has the proportional component.

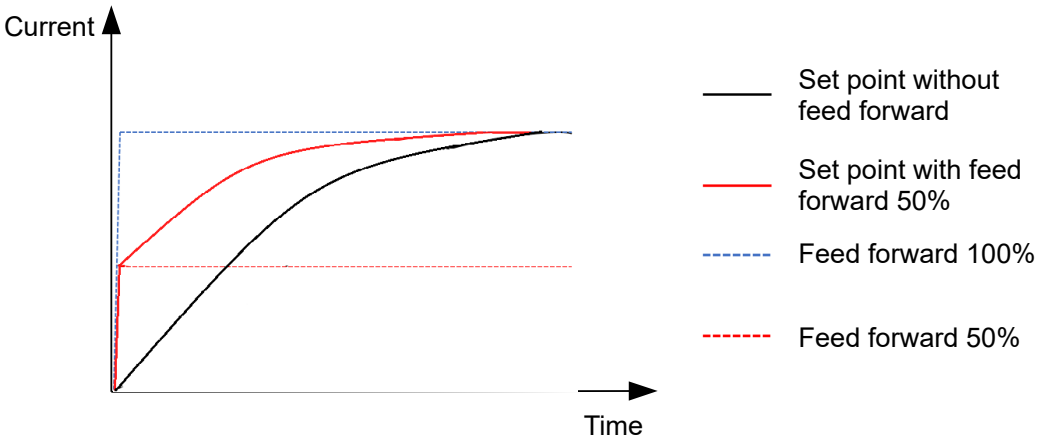
7.1.3.3 Feed forward

It is also possible to set a *velocity feed forward*, an *acceleration feed forward* (that corresponds to a torque/current value) and a *voltage feed forward*.

You can use the *feed forward* to add an already known or anticipated control variable to the set point ("predictive"). You can, e. g., compensate for the inertia of the load by adding an acceleration feed forward value to the output of the velocity controller.

The feed forward values are additionally fed to the speed/current control loop or added to the voltage value and are immediately available. A more dynamic control can thereby be achieved.

The following figure shows the current (produced by the acceleration) during the acceleration phase as a function of the *acceleration feed forward*. At a feed forward value of "50%", the current is at "50%" already at the start of the acceleration phase; the current controller is thereby "relieved".

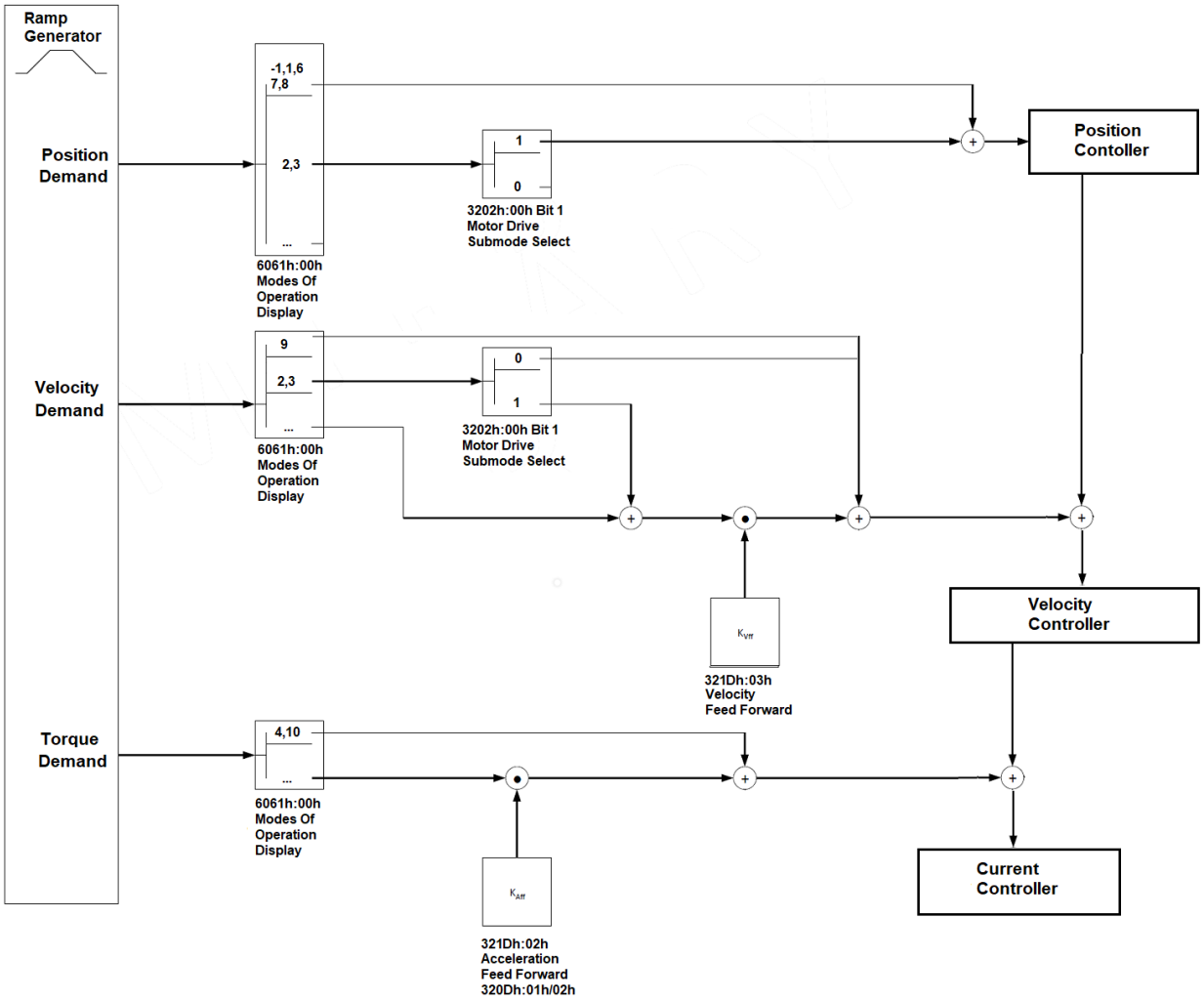


The factor for the *velocity feed forward* is set in object 321D$_h$:03$_h$ in tenths of a percent of the output of the ramp generator (606B$_h$) and added to the output of the position controller before the velocity controller. The *velocity feed forward* is active in all modes with position control loop:

- Profile Position
- Homing
- Interpolated Position Mode
- Cyclic Synchronous Position
- Clock-direction mode
- Profile Velocity if bit 1 in 3202$_h$ is set to "1"

The factor for the *acceleration feed forward* is set in object 321D$_h$:02$_h$ in tenths of a percent of the factor of 320D$_h$ and multiplied by the output of the ramp generator (6074$_h$). The value is added to the output of the velocity controller before the current controller. The *acceleration feed forward* is active in all modes, with the exception of the torque modes.

The following figure shows the cases in which the feed forward is active and the position of the feed forward within the controller cascade.



The d- and q-current controllers have a reciprocal influence on one another. To neutralize this coupling, voltages are precalculated by the controller and added to the voltages calculated by the current controller. You can adjust this decoupling with object $321D_h$:01_h (factory setting 1000 ‰).

The voltage required for a desired current can be precalculated based on the value for the ohmic resistance determined in auto setup. With object $321D_h$:04_h, you can adjust the precalculated voltage (factory setting 0 ‰). If this voltage is immediately available, the actual current can very quickly follow the set value and support the integral component of the current controller. When using this *voltage feed forward*, you should increase the Ti time values of the current controller in object $321A_h$ accordingly (significantly).

7.1.3.4 Assignment of the feedbacks to the control loops

In object 3203_h, you define which of the existing feedbacks the controller takes into account for the individual controllers (current controller/commutation, velocity, position). You can also use a second sensor for the commutation (see Commutation help).

Each subindex of the object contains a bit mask for the respective feedback of a sensor. The bits have the following meaning here:

- Bit 0: If the bit is set to "1", this sensor is used for position feedback.
- Bit 1: If the bit is set to "1", this sensor is used for velocity feedback.
- Bit 2: If the bit is set to "1", this sensor is used for commutation feedback in Closed-Loop.

Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

Which sensor the controller takes into account for the individual controllers (commutation, velocity, position) is implicitly specified by the order of the sensors.

The search always begins with sensor 2 and continues in ascending order until all existing sensors have been queried. If a sensor is found whose feedback is set, it is assigned to the corresponding controller and the search ended.

Object 3205_h shows which sensor is currently used for which control circuit.

Example

The controller has two physical interfaces. Hall sensors and a (non-absolute) incremental encoder were connected.

Bit	Controller	Feedback 1 Sensorless	Feedback 2 Hall	Feedback 3 Incremental encoder
0	Position	0	0	1
1	Velocity	0	1	1[1]
2	Commutation	0	1[2]	1
	Index:Subindex	$3203_h:01_h$	$3203_h:02_h$	$3203_h:03_h$

[1]The Hall sensors should be used for velocity control, the encoder for the positioning and commutation. Although the bit for the velocity was also set for the third feedback, this is not taken into account.

[2]Immediately after switching on − and until the index of the encoder is passed over for the first time − commutation is to take place via the Hall sensors and immediately enable *closed-loop* mode.

Commutation help

Some sensors are initially lacking the alignment necessary for the commutation (offset between the index of the encoder and the magnets of the rotor). This means that the rotor orientation cannot be determined using only the position information of the sensor.

For assistance, you can set a second sensor as commutation sensor (bit 2 of the corresponding subindex in 3203_h). It is thereby possible, for example, for each (electric) absolute sensor with alignment (such as a Hall sensor), to offer commutation assistance, e. g., for an incremental encoder without index or still missing alignment (index signal not yet seen since a restart). The controller automatically uses the better sensor for the commutation.

7.1.3.5 Commissioning

An auto setup should be performed before using *closed-loop* mode. The auto setup operating mode automatically determines the necessary parameters (e.g., motor data, feedback systems) that are necessary for optimum operation of the field oriented control. All information necessary for performing the auto setup can be found in chapter Auto setup.

To use *closed-loop* mode, certain settings are necessary depending on the motor type and feedback; see chapter Setting the motor data.

Bit 0 in 3202_h must be set . The bit is set automatically after a successfully completed auto setup.

Activation

If an (electric) absolute sensor (e.g., Hall sensor) is used for the commutation, the *closed-loop* is activated automatically already when switching on.

If an encoder is used for the commutation, the index of the encoder must be passed over at least once after switching on before *closed-loop* can be activated (remains in *open-loop* mode until this takes place).

If no index is present or if it cannot be used, you can use a second sensor for commutation (see Assignment of the feedbacks to the control loops).

Bit 15 in 6041h Statusword indicates whether or not *closed-loop* is active (if the state of CiA 402 Power State Machine is *Operation enabled*).

7.1.3.6 Optimizations

In *closed-loop*, the measured control variable (actual value) is constantly compared with a set point (set value). In the event of deviations between these values, the controller readjusts according to the specified control parameters.

The objective of control parameter optimization (the so-called *tuning* of the controller) is the smoothest possible running of the motor, high accuracy and high dynamics in the reaction of the controller to faults. All control deviations should be eliminated as quickly as possible.

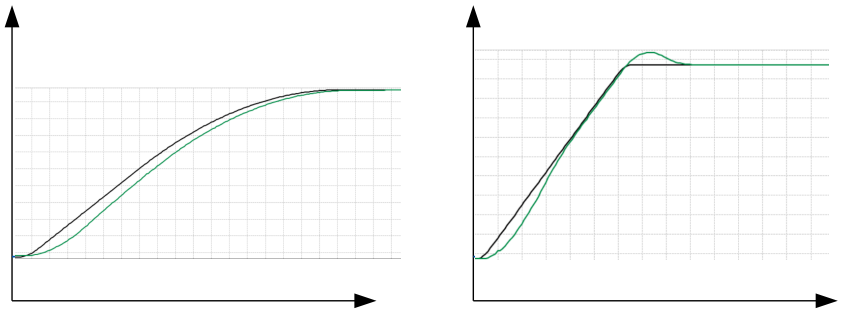
Due to the cascaded Controller structure, it is useful to start the optimization of the inner-most controller (current controller) before the velocity and – if applicable – the position controller are optimized. Each of the three controllers consists of a proportional and an integral component, which should normally be adjusted in this order.

You can calculate the current controller parameters on the basis of the motor parameters as follows:

1. $K_p=L/(4*T_c)$, where L is the winding inductance in henrys and T_c is the sampling time (see Cycle times) in seconds.
2. $K_i=L/R$, where R is the winding resistance in ohm.
3. Convert units and enter values in the corresponding subindices:
   $321A_h:01_h=K_p*10^3$
   $321A_h:02_h=K_1*10^6$

The following figures show the reaction of the controller to a change in set value.

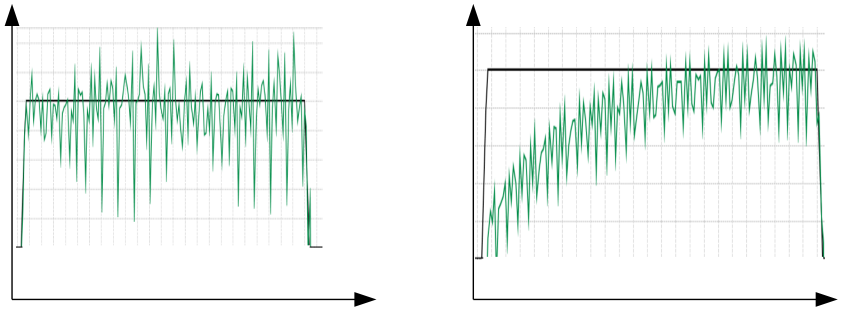
If the proportional component is too small, the actual value remains below the set value. A proportional component that is too large, on the other hand, results in "overshooting".



P-part too small

P-part too big

If the integrator time is too small, the system tends toward oscillations. If the integrator time is too large, the deviations are compensated for too slowly.



Ti too small

Ti too big

CAUTION!

Risk of injury through uncontrolled motor movements!

Incorrect control parameters may result in an unstable control behavior. Unforeseen reactions can result.

► Increase the control parameters slowly and incrementally. Do not increase these further if you notice strong vibrations/oscillations.

► Do not reach for moving parts during operation. After switching off, wait until all movements have ended.

7.2 Cycle times

The controller operates with a cycle time of 1 ms. This means that data are processed every 1 ms; multiple changes to a value (e.g., value of an object or level at a digital input) within one ms cannot be detected.

The following table includes an overview of the cycle times of the various processes.

Task	Cycle time
Application	1 ms
NanoJ application	1 ms
Current controller	62.5 µs (16 kHz)
Velocity controller	250 µs (4 kHz)
Position controller	1 ms

8 Special functions

8.1 Digital inputs and outputs

This product is equipped with digital inputs and outputs. You can find the exact number for the given product variant in chapter Pin assignment.

In 323Ah User Pin Settings, you configure the hardware as follows:

- Subindex 01_h: Here, you define the level for the inputs/outputs:
  - Value "0": 5 V
  - Value "1": 24 V (inputs) or +UB_Logic (outputs)

NOTICE

For the inputs, always use a voltage that is smaller than the operating voltage +UB_Logic.

- Subindex 02_h: Here, you define the wiring for the digital inputs:
  - Value "0" (Pull-Down): High level at 5/24 V on the pin.
  - Value "1" (Pull-Up): High level without external voltage on the pin.

8.1.1 Digital inputs

8.1.1.1 Overview

NOTICE

For digital inputs with 5 V, the length of the supply lines must not exceed 3 meters.

NOTICE

The digital inputs are sampled once per millisecond. Signal changes at the input less than one millisecond in duration are not processed.

Input	Special function	Switching threshold switchable (see $323A_h$)	Differential / single-ended
1	Negative limit switch	yes, 5 V or 24 V (=UB_Logic)	single-ended
2	Positive limit switch	yes, 5 V or 24 V (=UB_Logic)	single-ended
3	Home switch	yes, 5 V or 24 V (=UB_Logic)	single-ended
4	None	yes, 5 V or 24 V (=UB_Logic)	single-ended
5	None	yes, 5 V or 24 V (=UB_Logic)	single-ended
6	None	yes, 5 V or 24 V (=UB_Logic)	single-ended

8.1.1.2 Computation of the inputs

Object $60FD_h$ (Digital Inputs) contains a summary of the inputs and the special functions. The current status of the inputs is likewise read out from object 324Ah Inputs (including Hall sensors and incremental encoders, if present).

The following table lists the value of the corresponding bit in the respective object for the inputs depending on the configuration in 323Ah User Pin Settings:

Voltage at pin	Subindex 02 (Pull-Up Enable)	Subindex 01 (Voltage Level Select)	Bit value
n.c	0 (Pull-Down)	X	0
GND	0 (Pull-Down)	X	0
5 V	0 (Pull-Down)	0 (5 V)	1
5 V	0 (Pull-Down)	1 (24 V)	0
24 V	0 (Pull-Down)	1 (24 V)	1
n.c.	1 (Pull-Up)	X	1
GND	1 (Pull-Up)	X	0
5 V	1 (Pull-Up)	0 (5 V)	1
5 V	1 (Pull-Up)	1 (24 V)	0
24 V	1 (Pull-Up)	1 (24 V)	1

8.1.1.3 Special functions

The firmware evaluates the following bits in 60FD$_h$:

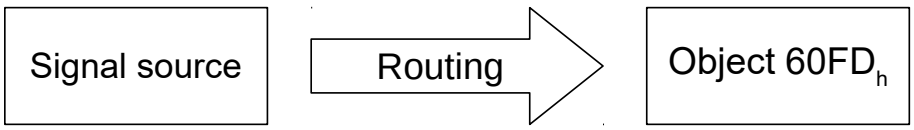
- Bit 0: Negative limit switch (see Limitation of the range of motion)
- Bit 1: Positive limit switch (see Limitation of the range of motion)
- Bit 2: Home switch (see Homing)
- Bit 3: Interlock (see interlock function)

You define the assignment of the bits to the pins with the *Input Routing*.

8.1.1.4 Input Routing

Principle

To perform the assignment of the inputs more flexibly, there is a mode called *Input Routing Mode*. This assigns a signal of a source to a bit in object 60FD$_h$.



Routing

Object 3242$_h$ determines which signal source is routed to which bit of 60FD$_h$. Subindex 01$_h$ of 3242$_h$ determines bit 0, subindex 02$_h$ determines bit 1, and so forth. The signal sources and their numbers can be found in the following lists.

Number		Signal source
dec	hex	
00	00	Signal is always 0
01	01	physical input 1
02	02	Physical input 2
03	03	Physical input 3
04	04	Physical input 4
05	05	Physical input 5
06	06	Physical input 6
07	07	Physical input 7

Number		Signal source
dec	hex	
08	08	Physical input 8
09	09	Physical input 9
10	0A	physical input 10
11	0B	Physical input 11
12	0C	physical input 12
13	0D	Physical input 13
14	0E	Physical input 14
15	0F	Physical input 15
16	10	Physical input 16
65	41	Hall input "U"
66	42	Hall input "V"
67	43	Hall input "W"
68	44	Encoder input "A"
69	45	Encoder input "B"
70	46	Encoder input "Index"
71	47	USB Power Signal
72	48	"Ethernet active" status
81	51	Negative block
82	52	Positive block
90	5A	Analog input 1
91	5B	Analog input 2
100	64	STO_IN_A
101	65	STO_IN_B

The following table describes the inverted signals of the previous table.

Number		Signal source
dec	hex	
128	80	Signal is always 1
129	81	Inverted physical input 1
130	82	Inverted physical input 2
131	83	Inverted physical input 3
132	84	Inverted physical input 4
133	85	Inverted physical input 5
134	86	Inverted physical input 6
135	87	Inverted physical input 7
136	88	Inverted physical input 8
137	89	Inverted physical input 9
138	8A	Inverted physical input 10
139	8B	Inverted physical input 11
140	8C	Inverted physical input 12
141	8D	Inverted physical input 13
142	8E	Inverted physical input 14
143	8F	Inverted physical input 15

Number		Signal source
dec	hex	
144	90	Inverted physical input 16
193	C1	Inverted Hall input "U"
194	C2	Inverted Hall input "V"
195	C3	Inverted Hall input "W"
196	C4	Inverted encoder input "A"
197	C5	Inverted encoder input "B"
198	C6	Inverted encoder input "Index"
199	C7	Inverted USB power signal
200	C8	"Ethernet active" inverted status
218	DA	Inverted analog input 1
219	DB	Inverted analog input 2
228	E4	Inverted STO_IN_A
229	E5	Inverted STO_IN_B

Example

Input 1 is to be routed to bit 16 of object 60FD$_h$:

The number of the signal source for input 1 is "1". The routing for bit 16 is written in 3242$_h$:11$_h$.

Hence, object 3242$_h$:11$_h$ must be set to the value "1".

8.1.1.5 Interlock function

The interlock function is a release that you control via bit 3 in 60FD$_h$. If this bit is set to "1", the motor can move. If the bit is set to "0", the controller switches to the error state and the action stored in 605E$_h$ is executed.

Use *Input Routing* to define which signal source is routed to bit 3 of 60FD$_h$ and is to control the interlock function.

Example

Input 4 is to be routed to bit 3 of object 60FD$_h$ to control the interlock function. A low level is to result in an error state.

1. To route input 4 to bit 3, set 3242$_h$:04$_h$ to "4".

8.1.2 Digital outputs

8.1.2.1 Outputs

The outputs are controlled via object 60FE$_h$. Here, output 1 corresponds to bit 16 in object 60FE$_h$, output 2 corresponds to bit 17, etc., as with the inputs. The outputs with special functions are entered in the firmware in the lower bits 0 to 15. The only bit assigned at the present time is bit 0, which controls the motor brake.

8.1.2.2 Wiring

NOTICE

Always observe the maximum capacity of the output (see Pin assignment).

NOTICE

To use the digital outputs, you must connect a voltage (12…30 V DC) to pins 1 and 2 of X2 — voltage supply (logic supply).

The output voltage then corresponds to

- this logic voltage if you set $323A_{hh}$:01_h to "1",
- 5 V if you set $323A_h$:01_h to "0" (factory setting).

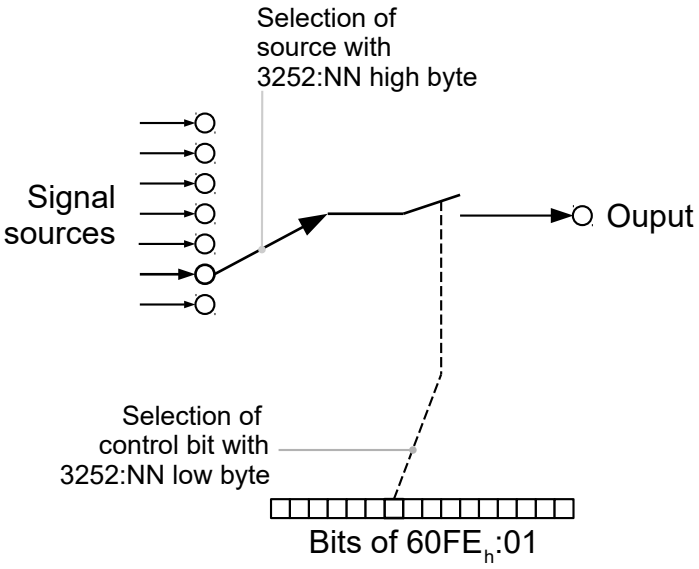
The current should not exceed 100 mA.

8.1.2.3 Output Routing

Principle

The "Output Routing Mode" assigns an output a signal source; a control bit in object $60FE_h$:01_h switches the signal on or off.

The source is selected with 3252_h:01 to n in the "high byte" (bit 15 to bit 8). The assignment of a control bit from object $60FE_h$:01_h is performed in the "low byte" (bit 7 to bit 0) of 3252_h:01_h to n (see following figure).



Routing

The subindex of object 3252_h determines which signal source is routed to which output. The output assignments are listed in the following:

Subindex 3252_h	Output Pin
01_h	Configuration of the brake output (PWM output)
02_h	Configuration of output 1
03_h	Configuration of output 2 (if available)
…	…

Subindex 3252_h	Output Pin
$0n_h$	Configuration of output n (if available)

NOTICE

The maximum output frequency of the PWM output (software PWM) is 2 kHz. All other outputs can only produce signals up to 500 Hz.

Subindices 3252_h:01_h to $0n_h$ are 16 bits wide, whereby the high byte selects the signal source (e. g., the PWM generator) and the low byte determines the control bit in object $60FE_h$:01.

Bit 7 of 3252_h:01_h to $0n_h$ inverts the controller from object $60FE_h$:01. Normally, value "1" in object $60FE_h$:01_h switches on the signal; if bit 7 is set, the value "0" switches on the signal.

Number in 3252:01 to 0n	
$00XX_h$	Output is always "1"
$01XX_h$	Output is always "0"
$02XX_h$	Encoder signal (6063_h) with frequency divider 1
$03XX_h$	Encoder signal (6063_h) with frequency divider 2
$04XX_h$	Encoder signal (6063_h) with frequency divider 4
$05XX_h$	Encoder signal (6063_h) with frequency divider 8
$06XX_h$	Encoder signal (6063_h) with frequency divider 16
$07XX_h$	Encoder signal (6063_h) with frequency divider 32
$08XX_h$	Encoder signal (6063_h) with frequency divider 64
$09XX_h$	Position Actual Value (6064_h) with frequency divider 1
$0AXX_h$	Position Actual Value (6064_h) with frequency divider 2
$0BXX_h$	Position Actual Value (6064_h) with frequency divider 4
$0CXX_h$	Position Actual Value (6064_h) with frequency divider 8
$0DXX_h$	Position Actual Value (6064_h) with frequency divider 16
$0EXX_h$	Position Actual Value (6064_h) with frequency divider 32
$0FXX_h$	Position Actual Value (6064_h) with frequency divider 64
$10XX_h$	PWM signal that is configured with object 2038_h:05_h and 06_h for brake output
$12XX_h$	PWM signal that is configured with object 3260_h
$13XX_h$	PWM signal that is configured with object 3261_h
$20XX_h$	Pulse generator

NOTICE

On any change of the "encoder signal" (6063_h) or the current position (6064_h in user-defined units) by an increment, a pulse is output at the digital input (for frequency divider 1). Take this into account when selecting the frequency divider and the unit, especially when using sensors with low resolution (such as Hall sensors).

Example

The encoder signal (6063_h) is to be applied to output 1 with a frequency divider 4. The output is to be controlled with bit 5 of object 60FE:01.

- 3250_h:08_h = 1 (activate routing)
- 3252_h:02_h = 0405_h ($04XX_h$ + 0005_h)
- $04XX_h$: Encoder signal with frequency divider 4
- 0005_h: Selection of bit 5 of 60FE:01

The output is switched on by setting bit 5 in object 60FE:01.

Example

The brake PWM signal is to be applied to output 2. Because the automatic brake control uses bit 0 of 60FE:01_h, this should be used as control bit.

- 3250_h:08_h = 1 (activate routing)
- 3252_h:03_h = 1080_h (=$10XX_h$ + 0080_h). Where:
  - $10XX_h$: Brake PWM signal
  - 0080_h: Selection of the inverted bit 0 of object 60FE:01

8.1.3 Pulse generator

You have the option of outputting the actual position via two pins of the controller and passing it on to your PLC or another controller. The maximum frequency here is 200 kHz.

Activating the function of the pins

To activate the function, use *Output Routing* and set the source in the corresponding subindices of 3252_h to $20XX_h$.

Selecting the type of output signals

You can select one of the following types in object $205C_h02_h$:

- Value "0": two 90° phase-shifted channels on channel A (leading when moving in the positive direction) and B, analogous to an incremental encoder
- Value "1": a clock and direction signal on channel A and B, analogous to the signals in Clock-direction mode
- Value "2": two clock signals, analogous to the signals in Right / left rotation mode (CW / CCW mode)

Selecting the source of the position data

The position data of one of the existing feedbacks are reproduced via the pulse generator output. To select the source, set bit 3 in the corresponding subindex of object 3203_h to "1".

If you do not set a bit, the value from 205C:01_h is used (max. 255 pulses). In this case, the pulses are sent continuously independent of the motor movement.

Setting the resolution of the output signals

Define the conversion of source signal into virtual encoder signals of the pulse generator via the numerator in 205C:03_h and the denominator in 205C:04_h.

8.2 Analog inputs

The controller has 2 analog inputs with 12-bit resolution. They are located on pins 16 and 18 of X4 – inputs and outputs..

You can read out the analog value in a NanoJ program and use it as you like, e. g., to specify the target speed.

8.2.1 Object entries

To read out and, if necessary, manipulate the value of the analog input, use the following OD settings:

- 3220_h (Analog Inputs):
  This object displays the instantaneous values of the analog inputs in *ADC digits*.
- 3320_h (Read Analogue Input):
  This object displays the instantaneous values of the analog inputs in user-defined units.
- 3321_h (Analogue Input Offset):
  This is the offset that is added to the read analog value (3220_h) before scaling (multiplier from object 3322_h and divisor from object 3323_h).
- 3322_h(Analogue Input Factor Numerator):
  This is the value by which the read analog value (3220_h + 3321) is multiplied before it is written in object 3320_h.
- 3323_h(Analogue Input Factor Denominator):
  This is the value by which the read analog value (3220_h + 3321_h) is divided before it is written in object 3320_h.

8.2.2 Scale analog value

You read the value in object 3320_h (Read Analogue Input): This object displays the instantaneous values of the analog inputs in user-defined units.

The user-defined units are made up of offset (3321_h) and scaling value (3322_h/ 3323_h). If both are still set to the default values, the value in 3320_h is specified in the *millivolt* unit.

8.3 Automatic brake control

8.3.1 Description

Automatic brake control is activated if the controller is switched to the *Operation enabled* state of the CiA 402 Power State Machine; the brake otherwise always remains closed.

The brake output of the controller results in a PWM signal that can be adjusted with respect to frequency and duty cycle.

For information on the interaction of the brake with the motor stopping behavior, see also chapter Power State machine – halt motion reactions.

8.3.2 Activation and connection

The brake can be controlled either automatically or manually:

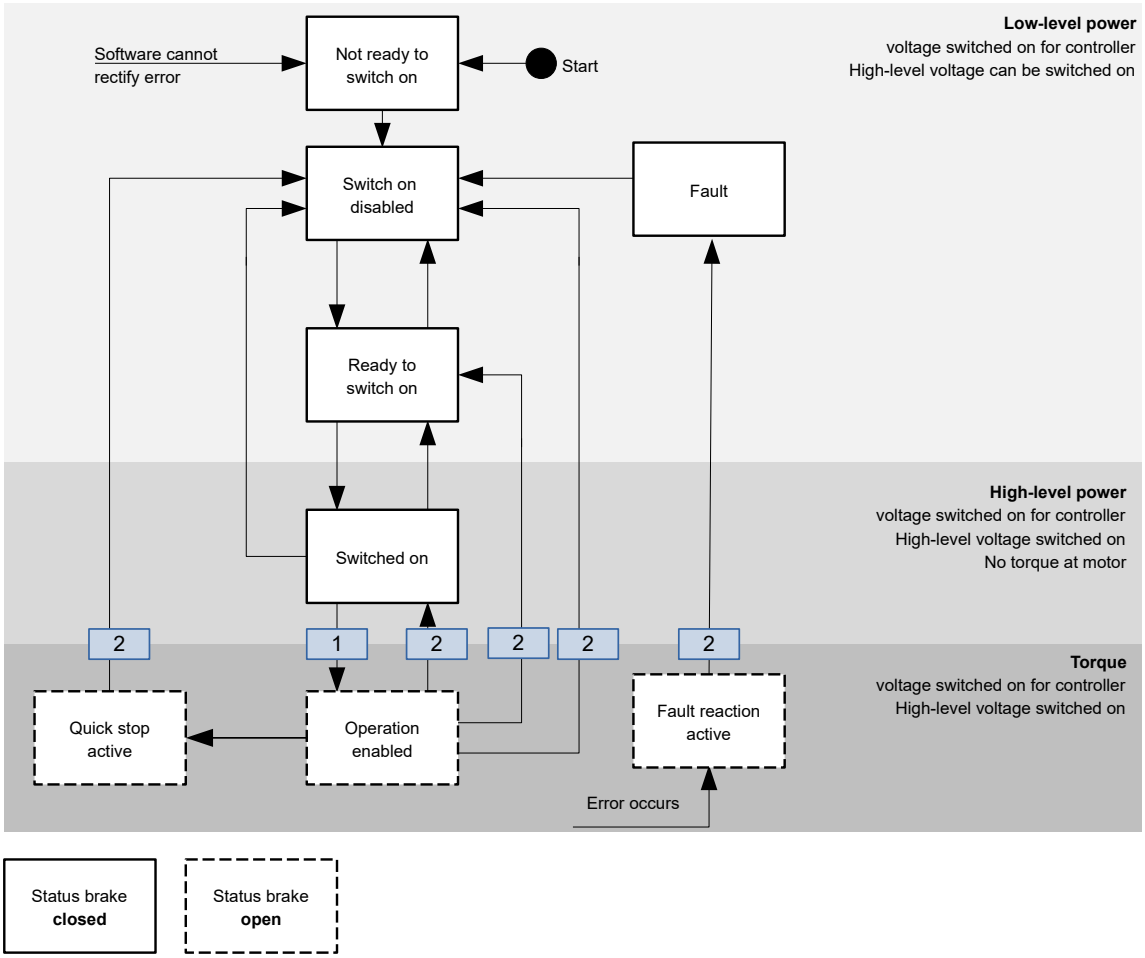
- Automatic: Setting bit 2 of object 3202_h to "1" activates the brake control.
- Manual: Setting bit 2 of object 3202_h to "0" deactivates the brake control; the brake can now be controlled with bit 0 in object $60FE_h$:01_h .

8.3.2.1 Connection

The brake output is located at X4 – inputs and outputs.

8.3.3 Brake control

The following graphic shows the states of the CiA 402 Power State Machine together with the states of the brake for the automatic mode.



The following steps are performed on the transition, which is marked with 1:

1. The motor current is switched on.
2. The time stored in 2038_h:3_h is allowed to elapse.
3. The brake releases.
4. The time stored in 2038_h:4_h is allowed to elapse.
5. The *Operation enabled* state is reached, the motor controller can perform travel commands.

The following steps are performed on all transitions that are marked with 2:

1. The motor is brought to a standstill.
2. The time stored in 2038_h:1_h is allowed to elapse.
3. The brake is activated.
4. The time stored in 2038_h:2_h is allowed to elapse.
5. The motor current is switched off.

8.3.4 Brake PWM

The switched-on brake generates a PWM signal at the output of the controller that can be adjusted with respect to duty cycle and frequency. If an output pin without PWM is needed, a duty cycle of 100 percent can be set. The maximum voltage at the *Brake +* pin equals the UB_Logic you have connected and should not be below 17 V for the brake to safely open.

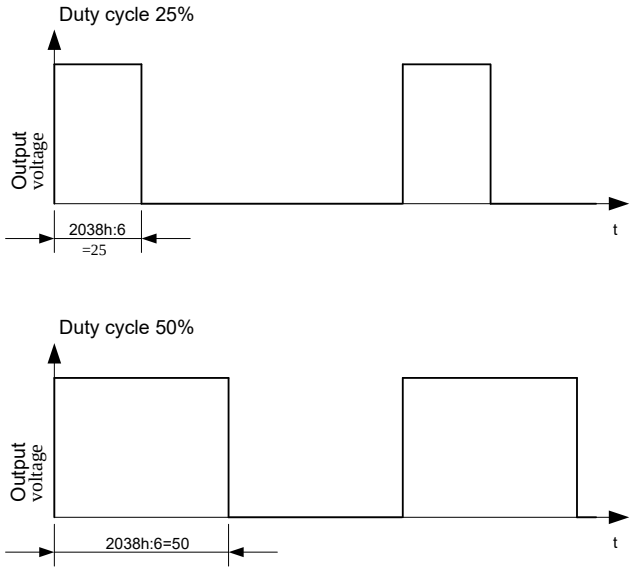
8.3.4.1 Frequency

The frequency of the brake PWM can be set in object 2038_h:5_h. The unit is Hertz; a value less than 50 or greater than 20000 is not possible.

8.3.4.2 Duty cycle

The duty cycle – the ratio of pulse to period duration – is set in 2038_h:6_h. The value is a percentage and can be selected between 1 and 100. With a value of 100, the output pin is permanently switched on.

In the following figure, example duty cycles of 25 and 50 percent are shown, whereby the frequency is held constant.



8.4 External brake chopper (ballast)

During braking, electrical energy is fed back into the DC-link through self-induction of the motor. If not using a power supply with regenerative-feedback capability, the brake power can cause the DC-link voltage to increase which, if no additional measures are taken, is limited only by the internal consumption and capacitances in the DC-link.

To prevent damage to the controller through overvoltage, it may – depending on the level of the braking power – be necessary to dissipate excess energy in the form of heat. For this purpose, the controller provides a connection at pins 3 / 4 of X2 — voltage supply for an external brake chopper.

8.4.1 Control of the ballast resistor

A ballast controller and monitor that has two functions is implemented in the firmware of the controller:

- Limitation of the DC-link voltage through activation of the ballast resistor or shutdown of the output stage
- Protection of the ballast resistor against thermal overload

The parameters to be configured are described in the following chapters.

8.4.2 Activating the brake chopper

To activate the brake chopper, set bit 0 in 4021_h:01_h to "1". To use the external brake chopper, set bit 2 in 4021_h:01_h to "1".

Enter the response threshold in millivolts as well as the hysteresis when switching on/off in 4021_h:02_h and 4021_h:03_h.

If, in spite of the activation, the brake chopper is not able to limit the increase in the DC-link voltage, an error is generated and the driver output stage switched off when the overvoltage threshold (2034_h) is exceeded.

8.4.3 Ballast monitoring

The firmware constantly monitors the ballast resistor by adding up the energy it converts – taking into account the thermal energy that the resistor discharges to its surroundings through convection.

If the energy exceeds the permissible limit value, the ballast resistor is blocked from switching on and a warning generated with error code 7113_h (see 1003_h). After the resistor has cooled sufficiently, the block is automatically canceled.

To configure the monitoring for the external resistance, you must ascertain or determine the following resistor parameters from the data sheet of the ballast resistor and enter them in the corresponding subindex of 4021_h:

Nominal Resistance $R_{Ballast}$, [mOhm]

Rated value of the ballast resistor

Cooling Power $P_{Stat_TA_Max}$, [mW]

The amount of heat that the resistor can/may constantly discharge to its surroundings. You can calculate these as follows:

$$P_{Stat_TA_Max} = (T_{Ballast_Max} - TA_{Max}) / R_{th,A}$$

- $T_{Ballast_Max}$: Maximum permissible surface temperature of the resistor. Limited by the data of the resistor (data sheet value) or by the installation position (temperature stability of adjacent components).
- TA_{Max}: Maximum temperature in the surroundings of the ballast
- $R_{th,A}$: Thermal resistance of the ballast resistor to the surroundings (data sheet value)

Short Term Energy Limit $E_{ST_25°C}$, [mWs]

Amount of energy that can be supplied to the resistor within a short load surge (<1 second) without overloading it.

The material of the resistor element (wire, thick film) is the limiting factor here as, in the case of short pulses, practically only it can absorb energy and heats up.

For load resistors, the value is typically specified in the data sheet.

Long Term Energy Limit $E_{LT_TA_Max}$, [mWs]

Amount of energy that can be supplied to the resistor within the *Long Term Reference Time* (see below, typically between 1 and 5 seconds) without overloading it.

In the case of long pulses, the carrier material (cement or ceramic body) also absorbs energy and thereby slows the temperature rise.

The long-term overload capacity of a load resistor is typically specified in its data sheet in the form of an overload factor for a certain length of time (e.g. 5x rated power for 5 seconds).

Long Term Reference Time t_{LT_Ref}, [ms]

The reference time for the Long Term Energy Limit (typically between 1 and 5 seconds)

If the parameters are not valid or realistic, an error is generated with error code 7110_h (see 1003_h).

8.5 I^2t Motor overload protection

8.5.1 Description

NOTICE

For stepper motors, only the rated current is specified, not a maximum current. No liability is therefore assumed when using I^2t with stepper motors.

The goal of I^2t motor overload protection is to protect the motor from damage and, at the same time, operate it normally up to its thermal limit.

This function is only available if the controller is in the closed loop mode (bit 0 of object 3202_h must be set to "1").

8.5.2 Object entries

The following objects affect I^2t motor overload protection:

- 6075_h Motor Rated Current – specifies the rated current in mA.
- 6073_h Max Current – specifies the maximum current in tenths of a percent of the set rated current.
- 3219_h:01_h I^2t Duration Of Max Current - specifies the maximum duration of the maximum current in ms.

8.5.3 Activation

Closed loop must be activated, (bit 0 of object 3202_h set to "1", see also chapter Closed-Loop).

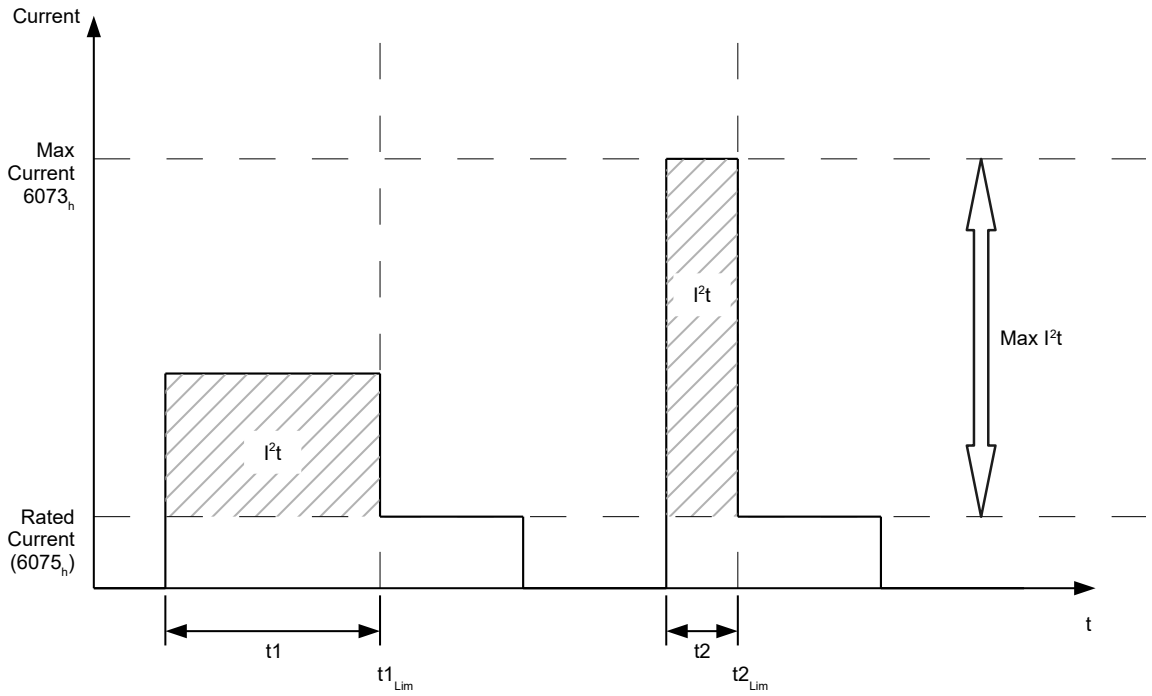
To activate the mode, you must describe the three object entries mentioned above in a meaningful way. This means that the maximum current must be greater than the rated current and a time value for the maximum duration of the maximum current must be entered. If these conditions are not met, the I^2t functionality remains deactivated.

8.5.4 Function of I^2t

From the specification of rated current, maximum current and maximum duration of the maximum current, an I^2t_{Lim} is calculated.

The motor can run with maximum current until the calculated I^2t_{Lim} is reached. The current is then immediately reduced to the rated current. The maximum current is limited by the maximum motor current (6073_h).

The relationships are illustrated again in the following diagrams.



In the first section, t1, the current value is higher than the rated current. At time $t1_{Lim}$, I^2t_{Lim} is reached and the current is limited to the rated current. A current that corresponds to the maximum current then occurs for a period of time t2. Hence, the value for I^2t_{Lim} is reached more quickly than in time t1.

8.6 Saving objects

NOTICE

Improper use of the function can result in it no longer being possible to start the controller. Therefore, carefully read the entire chapter before using the function.

NOTICE

As an alternative, objects can also be set and saved using the configuration file. Note that this file has higher priority. Objects that are saved both with the mechanism described here as well as in the configuration file take the value of the configuration file.

8.6.1 General

Many objects in the object dictionary can be saved and then automatically reloaded the next time the controller is switched on or reset. Furthermore, the saved values are also retained following a firmware update.

Only entire collections of objects (referred to in the following as *categories*) can be saved together; individual objects cannot be saved.

An object can be assigned one of the following *categories*:

- Communication: Parameters related to external interfaces, such as PDO configuration etc.
- Application: Parameters related to operating modes.
- User: Parameters that are written and read by the customer/user only and are ignored by the controller firmware.
- Motor: Parameters related to the motor (BLDC/stepper, motor current, *closed/open-loop*...). Some are set and saved by auto setup.
- Sensor: Parameters related to sensor/encoder that are set either by auto setup or that can be found in the data sheets.
- Ethernet: Parameters related to Ethernet communication

If an object is not assigned one of these *categories*, it cannot be saved, e.g., statusword and all objects whose value is dependent on the current state of the controller.

The objects in each *category* are listed below. In chapter Description of the CiA 402 object dictionary, the corresponding *category* for each object is also specified.

8.6.2 Category: Communication

- 2102_h: Fieldbus Module Control
- 3504_h: Shadow Mapping Object For PNU915 With Bit Size
- 3505_h: Additional PROFIdrive Mapping RX
- 3604_h: Shadow Mapping Object For PNU916 With Bit Size
- 3605_h: Additional PROFIdrive Mapping TX

8.6.3 Category: Application

- 0104_h: Configure Diagnostic Alarm
- $02CB_h$: Selection Switch For DO IO Data (subindex) In The Setpoint Telegram
- $02CC_h$: Selection Switch For DO IO Data (subindex) In The Actual Value Telegram
- $02EE_h$: Control Word 2 (STW2)
- $02F0_h$: Automatic Telegram Assignment
- 0320_h: Traverse Record Target Position
- 0321_h: Traverse Record Position Velocity

- 0322$_h$: Traversing Record Position Acceleration
- 0323$_h$: Traversing Record Position Deceleration
- 0328$_h$: Traverse Record Command Set Selection
- 032A$_h$: Target Position
- 032B$_h$: Position Velocity
- 032C$_h$: Position Acceleration
- 032D$_h$: Position Deceleration
- 0333$_h$: Position Mode
- 0334$_h$: Target Velocity NSOLL_A
- 0336$_h$: Target Velocity NSOLL_B
- 0338$_h$: Homing Speed
- 0339$_h$: Homing Acceleration
- 033E$_h$: Speed Error Tolerance Range
- 033F$_h$: Speed Error Tolerance Time
- 0340$_h$: Speed Comparison Value
- 0349$_h$: Torque Max Velocity
- 0368$_h$: Speed Control Acceleration
- 0369$_h$: Speed Control Deceleration
- 0372$_h$: Begin Acceleration Jerk
- 0373$_h$: Begin Deceleration Jerk
- 0374$_h$: End Acceleration Jerk
- 0375$_h$: End Deceleration Jerk
- 0382$_h$: Acceleration Reference Value
- 0383$_h$: Jerk Reference Value
- 0393$_h$: Selection Switch For DO IO Data In The Setpoint Telegram
- 0394$_h$: Selection Switch For DO IO Data In The Actual Value Telegram
- 039A$_h$: Telegram Selection
- 039F$_h$: Operation Priority Of Parameters
- 03A0$_h$: Control Priority DO IOData
- 03A2$_h$: Operating Mode
- 03C7$_h$: Control Word 1 (STW1)
- 2034$_h$: Upper Voltage Error Level [mV]
- 2035$_h$: Lower Voltage Error Level [mV]
- 2038$_h$: Brake Controller Timing
- 203D$_h$: Torque Window
- 203E$_h$: Torque Window Time Out
- 203F$_h$: Max Slippage Time Out
- 2057$_h$: Clock Direction Multiplier
- 2058$_h$: Clock Direction Divider
- 205B$_h$: Clock/Direction Or Clockwise/Counter-Clockwise Mode
- 205C$_h$: Pulse Generator Configuration
- 2290$_h$: PDI Control
- 2300$_h$: NanoJ Control
- 2800$_h$: Bootloader And Reboot Settings
- 30C2$_h$: Cut-off Frequency [mHz] To Filter The Velocity Demand Value Derived From Position Change
- 320D$_h$: Moment Of Inertia
- 3219$_h$: Current Configuration
- 321A$_h$: Current Controller Parameters
- 321B$_h$: Velocity Controller Parameters
- 321C$_h$: Position Controller Parameters
- 321D$_h$: Feedforward
- 321E$_h$: Voltage Limit
- 323A$_h$: User Pin Settings

- 3241$_h$: Digital Input Position Capture
- 3242$_h$: Digital Input Routing
- 3250$_h$: Digital Outputs Control
- 3252$_h$: Digital Output Routing
- 325A$_h$: Outputs
- 3260$_h$: Pwm Output 0
- 3261$_h$: Pwm Output 1
- 3262$_h$: Pwm Output 2
- 3273$_h$: Generic SPI Hardware Configuration
- 3274$_h$: Generic SPI Mosi Data
- 3321$_h$: Analog Input Offsets
- 3322$_h$: Analog Input Numerators
- 3323$_h$: Analog Input Denominators
- 3700$_h$: Deviation Error Option Code
- 3701$_h$: Limit Switch Error Option Code
- 4015$_h$: Special Drive Modes
- 4021$_h$: Ballast Configuration
- 6040$_h$: Controlword
- 605A$_h$: Quick Stop Option Code
- 605B$_h$: Shutdown Option Code
- 605C$_h$: Disable Operation Option Code
- 605D$_h$: Halt Option Code
- 605E$_h$: Fault Reaction Option Code
- 6060$_h$: Modes Of Operation
- 6065$_h$: Following Error Window
- 6066$_h$: Following Error Time Out
- 6067$_h$: Position Window
- 6068$_h$: Position Window Time
- 606D$_h$: Velocity Window
- 606E$_h$: Velocity Window Time
- 606F$_h$: Velocity Threshold
- 6070$_h$: Velocity Threshold Time
- 6071$_h$: Target Torque
- 6072$_h$: Max Torque
- 607A$_h$: Target Position
- 607B$_h$: Position Range Limit
- 607C$_h$: Home Offset
- 607D$_h$: Software Position Limit
- 607E$_h$: Polarity
- 607F$_h$: Max Profile Velocity
- 6080$_h$: Max Motor Speed
- 6081$_h$: Profile Velocity
- 6082$_h$: End Velocity
- 6083$_h$: Profile Acceleration
- 6084$_h$: Profile Deceleration
- 6085$_h$: Quick Stop Deceleration
- 6086$_h$: Motion Profile Type
- 6087$_h$: Torque Slope
- 6091$_h$: Gear Ratio
- 6092$_h$: Feed Constant
- 6096$_h$: Velocity Factor
- 6097$_h$: Acceleration Factor
- 6098$_h$: Homing Method

- 6099_h: Homing Speed
- $609A_h$: Homing Acceleration
- $60A2_h$: Jerk Factor
- $60A4_h$: Profile Jerk
- $60A8_h$: SI Unit Position
- $60A9_h$: SI Unit Velocity
- $60B0_h$: Position Offset
- $60B1_h$: Velocity Offset
- $60B2_h$: Torque Offset
- $60C1_h$: Interpolation Data Record
- $60C2_h$: Interpolation Time Period
- $60C4_h$: Interpolation Data Configuration
- $60C5_h$: Max Acceleration
- $60C6_h$: Max Deceleration
- $60F2_h$: Position Option Code
- $60F8_h$: Max Slippage
- $60FE_h$: Digital Outputs
- $60FF_h$: Target Velocity
- $EA60_h$: Velocity Reference Value

8.6.4 Category: User

- 2701_h: Customer Storage Area

8.6.5 Category: Motor

- 2030_h: Pole Pair Count
- 3202_h: Motor Drive Submode Select
- 6073_h: Max Current
- 6075_h: Motor Rated Current

8.6.6 Category: Sensor

- 3203_h: Feedback Selection
- 3380_h: Feedback Sensorless
- 3390_h: Feedback Hall
- $33A0_h$: Feedback Incremental A/B/I 1
- $33B0_h$: Feedback SSI 1
- $60E6_h$: Additional Position Encoder Resolution - Encoder Increments
- $60EB_h$: Additional Position Encoder Resolution - Motor Revolutions
- $60F1_h$: Additional Encoder Inversion

8.6.7 Category: Ethernet

- 2010_h: IP-Configuration
- 2011_h: Static-IPv4-Address
- 2012_h: Static-IPv4-Subnet-Mask
- 2013_h: Static-IPv4-Gateway-Address
- $EE49_h$: Ip Of Station
- $EE4B_h$: Default Gateway Of Station
- $EE4C_h$: Subnet Mask Of Station

8.6.8 Starting the save process

CAUTION!

Uncontrolled motor movements!

Control may be affected while saving. Unforeseen reactions can result.

► The motor must be at a standstill before starting the saving process. The motor must not be started while saving.

NOTICE

- Saving may take a few seconds. Never interrupt the power supply while saving. The state of the saved objects is otherwise undefined.
- Always wait until the controller has signaled that the save process has been successfully completed with the value "1" in the corresponding subindex in object 1010_h.

There is a subindex in object 1010_h for each *category*. To save all objects of this *category*, the value "65766173_h" must be written in the subindex. [2] The controller signals the end of the save process by overwriting the value with a "1".

The following table shows which subindex of object 1010_h is responsible for which *category*.

Subindex	Category
01_h	All categories with the exception of $0C_h$ (Ethernet)
02_h	Communication
03_h	Application
04_h	User
05_h	Motor
06_h	Sensor
$0C_h$	Ethernet

8.6.9 Discarding the saved data

If all objects or one *category* of saved objects is to be deleted, value "$64616F6C_h$" must be written in object 1011_h. [3]

The following subindices correspond to a *category* here:

Subindex	Category
01_h	All categories (reset to factory settings) with the exception of 06_h (Sensor) and $0C_h$ (Ethernet)
02_h	Communication
03_h	Application
04_h	User
05_h	Motor
06_h	Sensor

[2] This corresponds to the decimal of 1702257011_d or the ASCII string `save`.
[3] This corresponds to the decimal of 1684107116_d or the ASCII string `load`.

Subindex	Category
$0C_h$	Ethernet

The saved objects are subsequently discarded; the change does not take effect until after the controller is restarted. You can restart the controller by entering the value "$746F6F62_h$" in 2800_h:01_h.

NOTICE

- Objects of *category* 06_h (Sensor) are determined by Auto setup and are not reset when resetting to factory settings with subindex 01_h (thereby making it unnecessary to again perform an auto setup). You can reset these objects with subindex 06_h.

8.6.10 Verifying the configuration

Object 1020_h can be used to verify the configuration. It acts as a modification marker similar to common text editors: as soon as a file is modified in the editor, a marker (usually an asterisk) is added.

The entries of object 1020_h can be written with a date and time and then saved together with all other savable objects with 1010_h:01.

The entries of 1020_h are reset to "0" as soon as a savable object (including 1010_h:$0x_h$, except for 1010_h:01_h and 1020_h) is written.

The following sequence makes verification possible:

1. An external tool or master configures the controller.
2. The tool or master sets the value in object 1020_h.
3. The tool or master activates the saving of all objects 1010_h:01_h = 65766173_h. The date and time in object 1020_h are also saved.

After the controller is restarted, the master can check the value in 1020_h:01_h and 1020:01_h. If one of the values is "0", the object dictionary was changed after the saved values were loaded. This also applies for changes to the directory following a firmware update, e.g., if a stored object no longer exists. If the date or time in 1020 does not correspond to the expected value, objects were probably saved with values other than those that were expected.

8.7 Touch Probe (capture)

With this function, the sensor position can be recorded and noted automatically if a level change occurs at the digital input of the home switch or at two other inputs. The position is recorded internally by the controller independent of the cycle time of the application or PLC.

In object 3241_h, you determine for each of the three inputs the source (in absolute user units or in sensor increments) and the time at which the position is recorded:

- on rising edge
- on falling edge
- on both edges

9 Programming with NanoJ

NanoJ is a programming language similar to *C* or *C++*. NanoJ is integrated in the *Plug & Drive Studio 3* software. You can find further information in the document *Plug & Drive Studio 3: User Manual* at us.nanotec.com.

9.1 NanoJ program

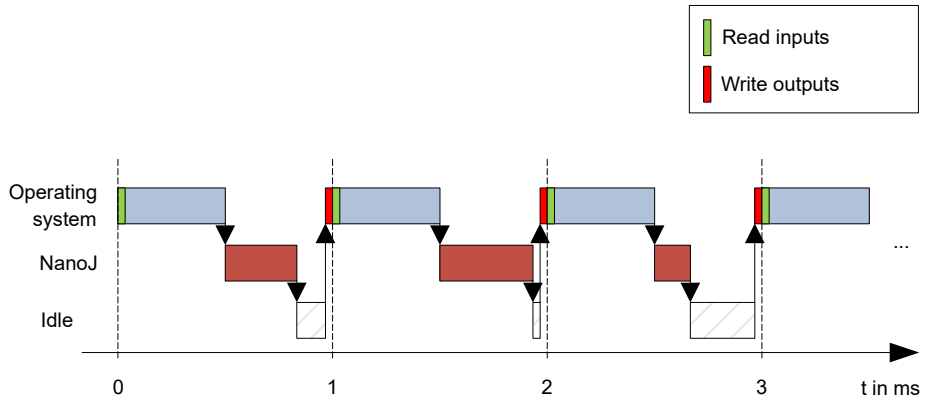
A *NanoJ program* makes a protected runtime environment available within the firmware. Here, the user can create his own processes. These can then trigger functions in the controller by, for example, reading or writing entries in the object dictionary.

Through the use of protective mechanisms, a *NanoJ program* is prevented from crashing the firmware. In the worst case, the execution is interrupted with an error code stored in the object dictionary.

If the *NanoJ program* was loaded on the controller, it is automatically executed after the controller is switched on or restarted, as long as you do not set bit 0 in object 2300_h to "0".

9.1.1 Available computing time

A *NanoJ program* receives computing time cyclically in a 1 ms clock (see following figure). Because computing time is lost through interrupts and system functions of the firmware, only part of computing time is available to the user program (depending on control mode and application). In this time, the user program must run through the cycle and either complete the cycle or yield the computing time by calling the `yield()` function. In the former case, the user program is restarted with the start of the next 1 ms cycle; the latter results in the program being continued on the next 1 ms cycle with the command that follows the `yield()` function.



If the *NanoJ program* needs more time than was allotted, it is ended and an error code set in the object dictionary.

TIP

When developing user programs, the runtime behavior must be carefully examined, especially for more time-intensive tasks. For example, it is therefore recommended that tables be used instead of calculating a sine value using a `sin` function.

NOTICE

If the *NanoJ program* does not yield the computing time after too long a time, it is ended by the operating system. In this case, the number `4` is entered in the statusword for object 2301_h; in the error register for object 2302_h, the number `5` (timeout) is noted, see 2301h NanoJ Status and 2302h NanoJ Error Code.

To keep the *NanoJ program* from stopping, you can activate *AutoYield* mode by writing value "5" in 2300_h. In *AutoYield* mode, however, the *NanoJ program* is no longer real-time capable and no longer runs every 1 ms.

9.1.2 Protected runtime environment

Using process-specific properties, a so-called *protected runtime environment* is generated. A user program in the protected runtime environment is only able to access specially allocated memory areas and system resources. For example, an attempt to directly write to a processor IO register is acknowledged with an *MPU Fault* and the user program terminated with the corresponding error code in the object dictionary.

9.1.3 NanoJ program – communication possibilities

A *NanoJ program* has a number of possibilities for communicating with the controller:

- Read and write OD values using PDO mapping
- Directly read and write OD values via NanoJ functions
- Call other NanoJ functions

The OD values of the user program are made available in the form of variables via *PDO mapping*. Before a user program receives the 1 ms time slot, the firmware transfers the values from the object dictionary to the variables of the user program. As soon as the user program receives computing time, it can manipulate these variables as regular C variables. At the end of the time slot, the new values are then automatically copied by the firmware back to the respective OD entries.

To optimize the performance, three types of mapping are defined: input, output, and input/output (In, Out, InOut).

- *Input mappings* can only be read; they are not transferred back to the object dictionary.
- *Output mappings* can only be written.
- *Input/output mappings*, on the other hand, can both be read and written.

The set mappings can be read and checked via the GUI for objects 2310_h, 2320_h, and 2330_h. Up to 16 entries are allowed for each mapping.

Whether a variable is stored in the input, output or data range is controlled in *Plug & Drive Studio* via the specification of the *linker section*.

NanoJ inputs and NanoJ outputs

To communicate with the *NanoJ program* via the respective interface, you can use the following objects:

- 2400h NanoJ Inputs: Array with thirty-two S32 values for passing values to the *NanoJ program*
- 2500h NanoJ Outputs: Array with thirty-two S32 values, where the *NanoJ program* can store values that can be read out via the fieldbus

9.1.4 Executing a NanoJ program

When executing a cycle, the *NanoJ program* essentially consists of the following three steps with respect to the PDO mapping:

1. Read values from the object dictionary and copy them to the input and output areas
2. Execute a user program
3. Copy values from the output and input areas back to the object dictionary

The configuration of the copy processes is based on the CANopen standard.

In addition, values of the object dictionary can be accessed via NanoJ functions. This is generally slower; mappings are therefore to be preferred. The number of mappings is limited (16 entries each in In/Out/InOut).

TIP

Nanotec recommends: Map OD entries that are used and changed frequently and use NanoJ function to access OD entries that are used less frequently.

A list of available NanoJ functions can be found in chapter NanoJ functions in the NanoJ program.

TIP

Nanotec recommends accessing a given OD value either by mapping or using a NanoJ function with `od_write()`. If both are used simultaneously, the NanoJ function has no effect.

9.1.5 NanoJ program – OD entries

The *NanoJ program* is controlled and configured in object range 2300_h to 2330_h (see 2300h NanoJ Control).

OD-Index	Name and description
2300_h	2300h NanoJ Control
2301_h	2301h NanoJ Status
2302_h	2302h NanoJ Error Code
2310_h	2310h NanoJ Input Data Selection
2320_h	2320h NanoJ Output Data Selection
2330_h	2330h NanoJ In/output Data Selection

Example:

To start the *TEST1.USR* user program, the following sequence can, for example, be used:

- Rename file "`TEST1.USR`" with `nanoj*.usr`.
- Copy file `nanoj*.usr` to the controller via USB and restart the controller.
- Start the NanoJ program by writing object 2300_h, bit 0 = "1".
- Check entry 2302_h for error code and object 2301_h, bit 0 = "1" (NanoJ program running).

To stop a running program: write entry 2300_h with bit 0 value = "0".

9.1.6 Structure of a NanoJ program

A user program consists of at least two instructions:

- the preprocessor instruction `#include "wrapper.h"`
- the `void user(){}` function

The code to be executed can be implemented in the `void user()` function.

NOTICE

In *NanoJ programs*, global variables may only be initialized within functions. It then follows:

- No `new` operator
- No constructors
- No initialization of global variables outside of functions

Examples:

The global variable is to be initialized within the `void user()` function:

```
unsigned int i;
void user(){
 i = 1;
 i += 1;
}
```

The following assignment results in an error during compilation:

```
unsigned int i = 1;
 void user() {
 i += 1;
}
```

9.1.7 NanoJ program example

The example shows the programming of a square wave signal in object 2500_h:01_h.

```
// file main.cpp
map S32 outputReg1 as inout 0x2500:1
#include "wrapper.h"

// user program
void user()
{
  U16 counter = 0;
  while( 1 )
  {
    ++counter;

    if( counter < 100 )
     InOut.outputReg1 = 0;
    else if( counter < 200 )
      InOut.outputReg1 = 1;
    else
      counter = 0;

    // yield() 5 times (delay 5ms)
    for(U08 i = 0; i < 5; ++i )
      yield();
  }
}// eof
```

You can find other examples at us.nanotec.com.

9.2 Mapping in the NanoJ program

With this method, a variable in the *NanoJ program* is linked directly with an entry in the object dictionary. The creation of the mapping must be located at the start of the file here, even before the `#include "wrapper.h"` instruction.

TIP

Nanotec recommends:

- Use mapping if you need to access an object in the object dictionary frequently, e. g., *controlword* 6040_h or *statusword* 6041_h.
- The `od_write()` and `od_read()` functions are better suited for accessing objects a single time, see Accessing the object dictionary.

9.2.1 Declaration of the mapping

The declaration of the mapping is structured as follows:

```
map <TYPE> <NAME> as <input|output|inout> <INDEX>:<SUBINDEX>
```

Where:

- `<TYPE>`

  The data type of the variable; U32, U16, U08, S32, S16 or S08.
- `<NAME>`
  The name of the variable as it is used in the user program.
- `<input|output|inout>`

  The read and write permission of a variable: a variable can be declared as an `input`, `output` or `inout`. This defines whether a variable is readable (`input`), writable (`output`) or both (`inout`) and the structure by means of which it must be addressed in the program.
- `<INDEX>:<SUBINDEX>`

  Index and subindex of the object to be mapped in the object dictionary.

Each declared variable is addressed in the user program via one of the three structures: *In*, *Out* or *InOut* depending on the defined write and read direction.

NOTICE

A comment is only permitted above the respective mapping declaration in the code, not on the same line.

9.2.2 Example of mapping

Example of a mapping and the corresponding variable accesses:

```
// 6040h:00h is UNSIGNED16
map U16 controlWord as output 0x6040:00
// 6041h:00h is UNSIGNED16
map U16 statusWord as input 0x6041:00

// 6060h:00h is SIGNED08 (INTEGER8)
map S08 modeOfOperation as inout 0x6060:00

#include "wrapper.h"

void user()
{
  [...]
  Out.controlWord = 1;
  U16 tmpVar = In.statusword;
  InOut.modeOfOperation = tmpVar;
  [...]
}
```

9.2.3 Possible error at `od_write()`

A possible source of errors is a write access with the `od_write()` function (see NanoJ functions in the NanoJ program) of an object in the object dictionary that was simultaneously created as mapping. The code listed in the following is incorrect:

```
map U16 controlWord as output 0x6040:00
```

```
#include " wrapper.h"
void user()
{
 [...]
  Out.controlWord = 1;
  [...]
  od_write(0x6040, 0x00, 5 ); // der Wert wird durch das Mapping überschrieben
  [...]
}
```

The line with the `od_write(0x6040, 0x00, 5 );` command has no effect. As described in the introduction, all mappings are copied to the object dictionary at the end of each millisecond.

This results in the following sequence:

1. The `od_write` function writes the value `5` in object 6040_h:00_h.
2. At the end of the 1 ms cycle, the mapping is written that also specifies object 6040_h:00_h, however, with the value `1`.
3. From the perspective of the user, the `od_write` command thus serves no purpose.

9.3 NanoJ functions in the NanoJ program

With NanoJ functions, it is possible to call up functions integrated in the firmware directly from a user program. Code can only be directly executed in the protected area of the protected execution environment and is realized via so-called *Cortex Supervisor Calls* (Svc Calls). Here, an interrupt is triggered when the function is called, thereby giving the firmware the possibility to temporarily permit code execution outside of the protected execution environment. Developers of user programs do not need to worry about this mechanism – for them, the NanoJ functions can be called up like normal C functions. Only the *wrapper.h* file needs to be integrated as usual.

9.3.1 Accessing the object dictionary

void **od_write** (U32 index, U32 subindex, U32 value)

This function writes the transferred value to the specified location in the object dictionary.

index	Index of the object to be written in the object dictionary
subindex	Subindex of the object to be written in the object dictionary
value	Value to be written

NOTICE

It is highly recommended that the processor time be passed on with `yield()` after calling a `od_write()`. The value is immediately written to the OD. For the firmware to be able to trigger actions that are dependent on this, however, it must receive computing time. This, in turn, means that the user program must either be ended or interrupted with `yield()`.

U32 **od_read** (U32 index, U32 subindex)

This function reads the value at the specified location in the object dictionary and returns it.

index	Index of the object to be read in the object dictionary
subindex	Subindex of the object to be read in the object dictionary
Output value	Content of the OD entry

NOTICE

Active waiting for a value in the object dictionary should always be associated with a `yield()`.

Example

```
while (od_read(2400,2) != 0) // wait until 2400:2 is set
{ yield(); }
```

9.3.2 Process control

```
void yield()
```

This function returns the processor time to the operating system. In the next time slot, the program continues at the location after the call.

```
void sleep (U32 ms)
```

This function returns the processor time to the operating system for the specified number of milliseconds. The user program is then continued at the location after the call.

ms	Time to be waited in milliseconds

9.4 Restrictions and possible problems

Restrictions and possible problems when working with NanoJ are listed below:

Restriction/problem	Measure
If an object is mapped, e. g., 0x6040, the object is reset to its previous value every 1 ms. This makes it impossible to control this object via the fieldbus or the *Plug & Drive Studio*.	Instead use `od_read` / `od_write` to access the object.
If an object was mapped as output and the value of the output was never defined before starting the *NanoJ program*, the value of this object may be random.	Initialize the values of the mapped outputs in your NanoJ program to ensure that it behaves deterministically.
The array initialization must not be used with more than 16 entries.	Use `constant array` instead.
Too many local variables and arrays within functions may result in a stack overflow.	Declare the variables globally. Memory requirements are monitored already during compilation; errors do not occur at runtime.
Functions that are too deeply nested may result in a stack overflow.	Observe a maximum nesting depth of 2.
`float` must not be used with comparison operators.	Use `int` instead.
`double` must not be used.	
If a NanoJ program restarts the controller (either directly with an explicit restart or indirectly, e. g., through the use of the Reset function), the controller may fall into a restart loop that can be exited only with difficulty if at all.	
`math` or `cmath` cannot be included.	

10 *CiA 402* operating modes and state machine

To use these other modes, set 930 Operating Mode to "0". You can use telegram 300 or 900.

10.1 CiA 402 Power State Machine

10.1.1 State machine

10.1.1.1 CiA 402

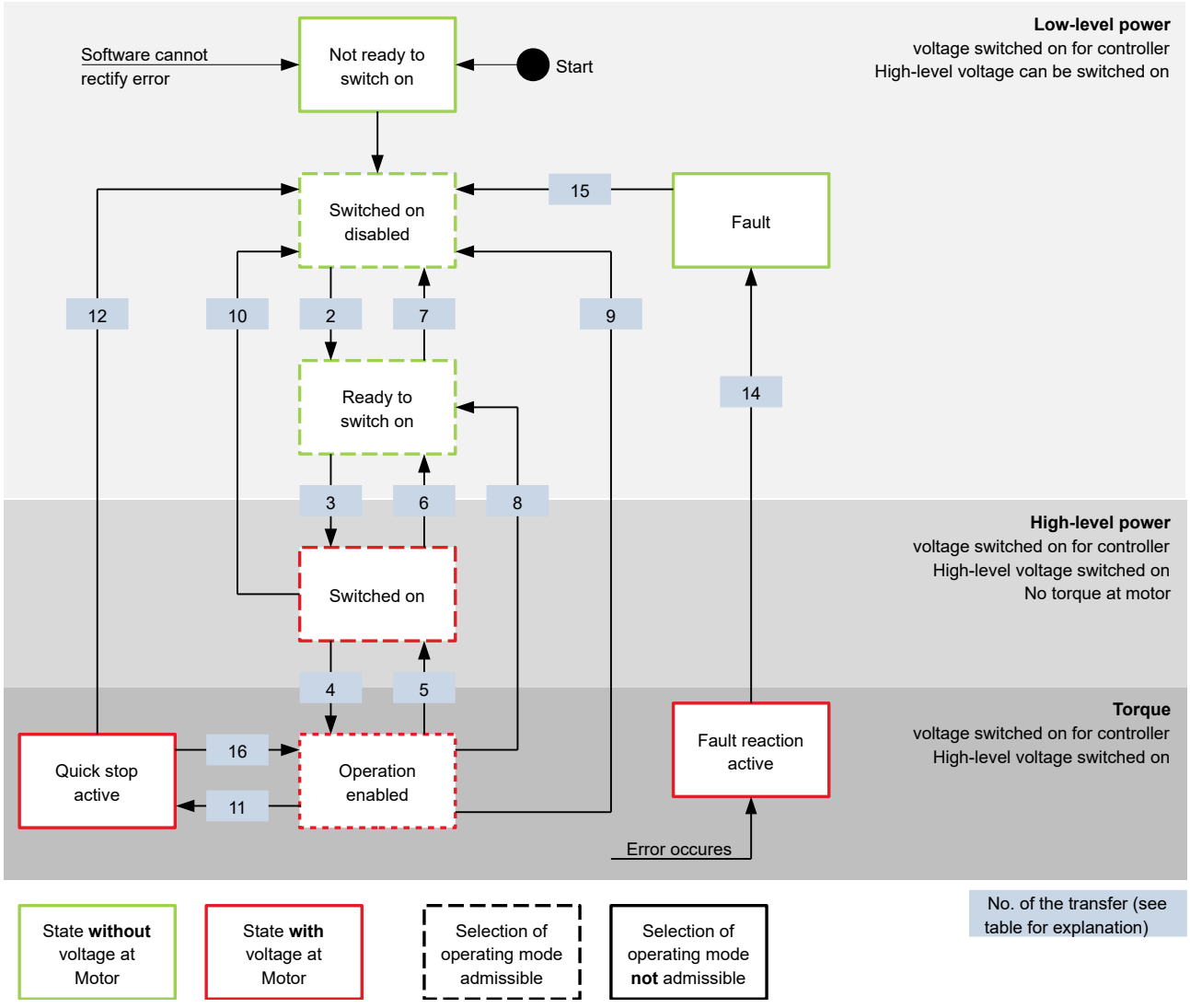
To switch the controller to the ready state, it is necessary to run through a *state machine*. This is defined in *CANopen standard 402*. State changes are requested in object 6040_h (controlword). The actual state of the state machine can be found in object 6041_h (statusword).

10.1.1.2 Controlword

State changes are requested via object 6040_h (controlword).

State transitions

The diagram shows the possible state transitions.



Listed in the following table are the bit combinations for the controlword that result in the corresponding state transitions. An X here corresponds to a bit state that requires no further consideration. Exceptions are the resetting of the error (fault reset) and the changeover from *Quick Stop Active* to *Operation Enabled*: the transition is only requested by the rising edge of the bit.

Command	Bit in object 6040_h					Transition
	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
Disable voltage	0	X	X	0	X	7, 10, 9, 12
Quick stop	0	X	0	1	X	11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4
Enable operation after Quick stop	0	1		1	1	16
Fault reset		X	X	X	X	15

10.1.1.3 Statusword

Listed in the following table are the bit masks that break down the state of the controller.

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

After switching on and successfully completing the self-test, the controller reaches the *Switch on disabled* state.

10.1.1.4 Operating mode

The operating mode is set in object 6060_h. The actually active operating mode is displayed in 6061_h.

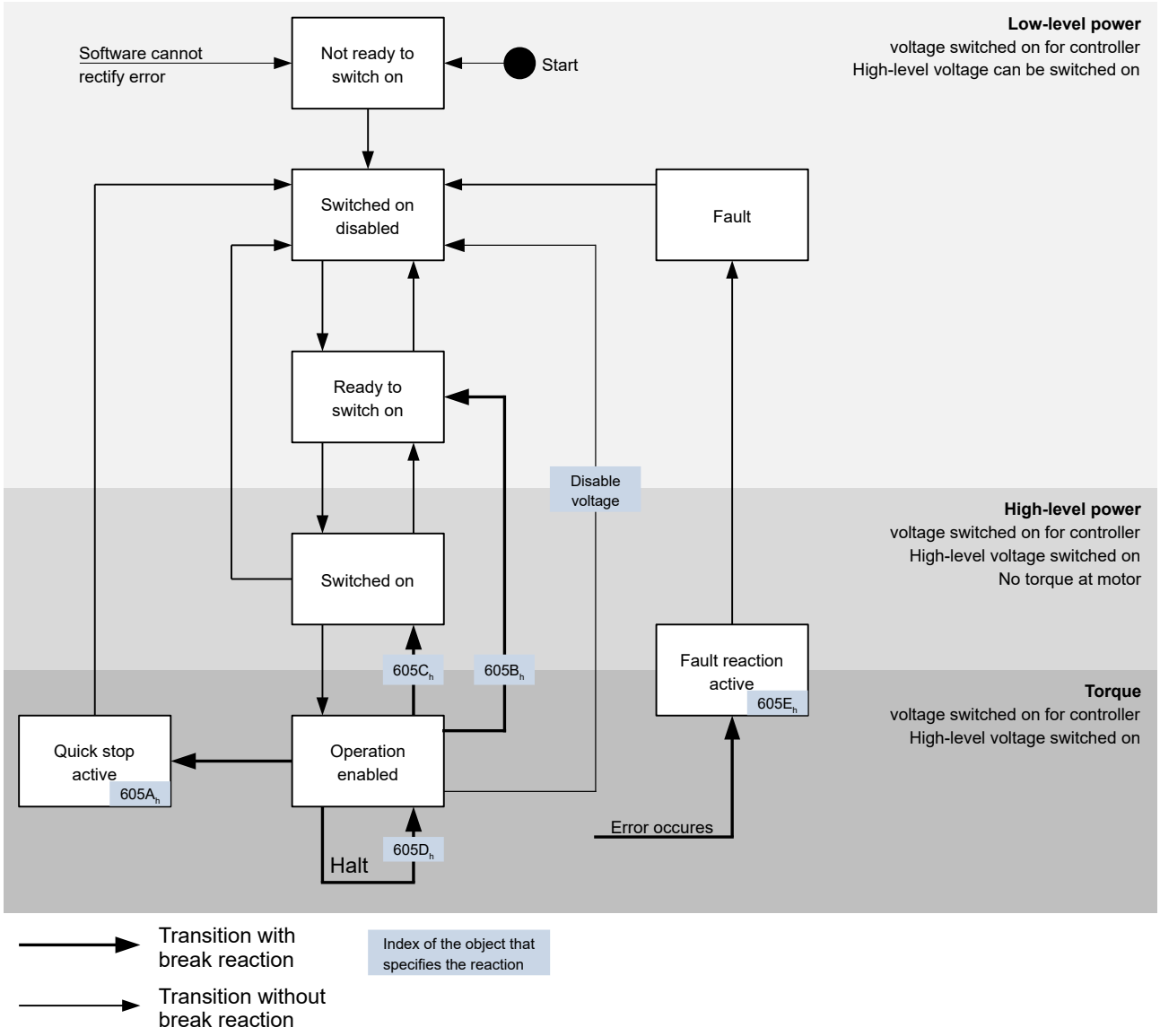
The operating mode can be set or changed at any time.

10.1.2 Behavior upon exiting the *Operation enabled* state

10.1.2.1 Halt motion reactions

Various halt motion reactions can be programmed upon exiting the *Operation enabled* state.

The following graphic shows an overview of the halt motion reactions.



10.1.2.2 Quick stop active

Transition to the *Quick stop active* state (quick stop option):

In this case, the action stored in object 605A$_h$ is executed (see following table).

Value in object 605A$_h$	Description
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely
1	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Switch on disabled*
2	Braking with *quick stop ramp* (6085$_h$) and subsequent state change to *Switch on disabled*
5	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Quick stop active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.

Value in object $605A_h$	Description
6	Braking with *quick stop ramp* (6085_h) and subsequent state change to *Quick Stop Active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.

The *Quick stop active* state can also be reached when a limit switch is actuated; see Limitation of the range of motion.

10.1.2.3 Ready to switch on

Transition to the *Ready to switch on* state (shutdown option):

In this case, the action stored in object $605B_h$ is executed (see following table).

Value in object $605B_h$	Description
-32768 … -1	Reserved
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely
1	Braking with *slow down ramp* (braking deceleration depending on operating mode) and subsequent state change to *Ready to switch on*
2 … 32767	Reserved

10.1.2.4 Switched on

Transition to the *Switched on* state (disable operation option):

In this case, the action stored in object $605C_h$ is executed (see following table).

Value in object $605C_h$	Description
-32768 … -1	Reserved
0	Switch off driver without deceleration ramp; drive function blocked
1	Braking with *slow down ramp* (braking deceleration depending on operating mode) and subsequent state change to *Switched on*
2 … 32767	Reserved

10.1.2.5 Halt

The bit is valid in the following modes:

- Profile Position
- Profile Velocity
- Profile Torque
- Interpolated Position Mode

When setting bit 8 in object 6040_h (controlword), the action stored in $605D_h$ is executed (see following table):

Value in object $605D_h$	Description
-32768 … 0	Reserved
1	Braking with *slow down ramp* (braking deceleration depending on operating mode)
2	Braking with *quick stop ramp* (6085_h)
3 … 32767	Reserved

10.1.2.6 Fault

Case of an error (fault):

If an error occurs, the motor will brake according to the value stored in object $605E_h$.

Value in object $605E_h$	Description
-32768 … -1	Reserved
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely
1	Braking with *slow down ramp* (braking deceleration depending on operating mode)
2	Braking with *quick stop ramp* (6085_h)
3 … 32767	Reserved

For each error that occurs, a more precise error code is stored in object 1003_h.

10.1.2.7 Following/slippage error

If a following or slippage error occurs, the motor is braked according to the value stored in object 3700_h.

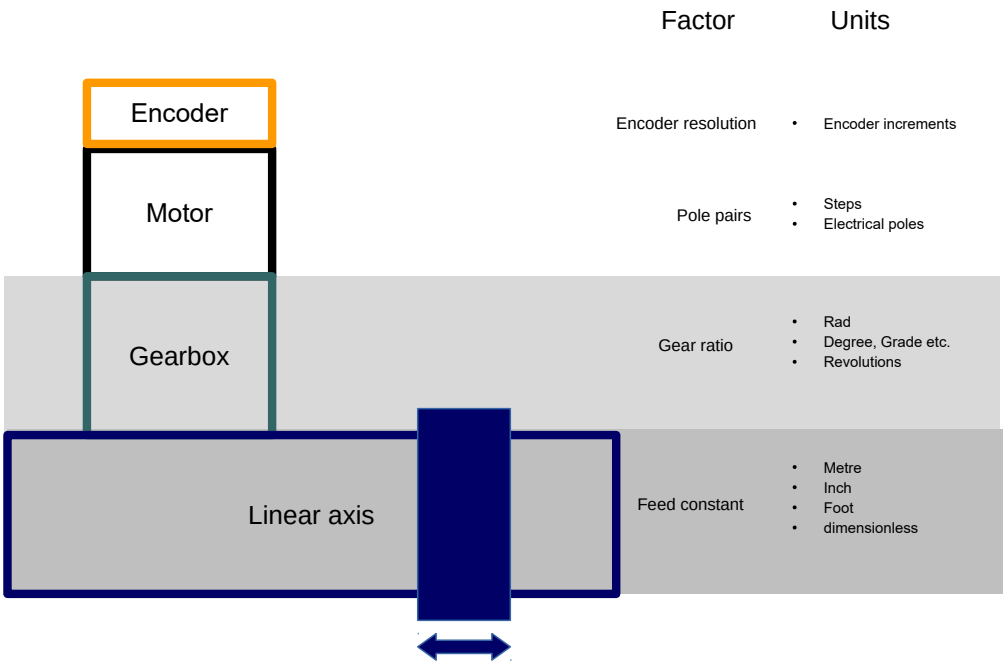
Value	Description
-32768 … -2	Reserved
-1	no reaction
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely
1	Braking with *slow down ramp* (braking deceleration depending on operating mode)
2	Braking with *quick stop ramp* (6085_h)
3 … 32767	reserved

You can deactivate error monitoring by setting object 6065_h to the value "-1" ($FFFFFFFF_h$) or object $60F8_h$ to the value "$7FFFFFFF_h$".

10.2 User-defined units

The controller offers you the possibility to set user-defined units. It is thereby possible to set and read out the corresponding parameters, e.g., directly in degrees [°], millimeter [mm], etc.

Depending on the mechanical circumstances, you can also define a Gear ratio and/or a Feed constant.



NOTICE

Value changes of all objects that are described in this chapter are not immediately applied in the *Operation enabled* state of the CiA 402 Power State Machine. For this to happen, the *Operation enabled* state must be exited.

10.2.1 Units

Units of the international unit system (*SI*) as well as a number of specific units are supported. It is also possible to specify a power of ten as a factor.

Listed in the following table are all supported units for the position and their values for $60A8_h$ (Position unit) or $60A9_h$ (Speed unit). Depending on the unit that is used, Feed constant (6092_h) and/or Gear ratio (6091_h) are/is taken into account.

Name	Unit symbol	Value	6091_h	6092_h	Description
meter	m	01_h	yes	yes	*Meter*
inch	in	$C1_h$	yes	yes	*Inch* (=0.0254 m)
foot	ft	$C2_h$	yes	yes	*Foot* (=0.3048 m)
grade	g	40_h	yes	no	*Gradian* (unit of angle, 400 corresponds to 360°)
radian	rad	10_h	yes	no	*Radian*
degree	°	41_h	yes	no	*Degrees*
arcminute	'	42_h	yes	no	*Arcminute* (60'=1°)
arcsecond	''	43_h	yes	no	*Arcsecond* (60''=1')
mechanical revolution		$B4_h$	yes	no	*Revolution*

Name	Unit symbol	Value	6091$_h$	6092$_h$	Description
encoder increment		B5$_h$	no	no	*Encoder increments.* Dependent on the used sensor (encoder/Hall sensor) and control mode. In *open-loop* and *sensorless* mode and if all other sensors in 3203$_h$ are deactivated, the number of pole pairs (2030$_h$) multiplied by 65536 corresponds to one motor revolution.
step		AC$_h$	no	no	*Steps.* With 2-phase stepper motors, the number of pole pairs (2030$_h$) multiplied by 4 is equivalent to one revolution. With 3-phase BLDC motors, the number of pole pairs (2030$_h$) multiplied by 6 is equivalent to one revolution.
electrical revolution		C0$_h$	no	no	*Electrical revolution.* With a stepper motor that has, e.g., 50 pole pairs (2030$_h$), the unit corresponds to 1/50 of a motor revolution.
dimensionless		00$_h$	yes	yes	*Dimensionless length unit*

Listed in the following table are all supported units for the time and their values for 60A9$_h$ (Speed unit):

Name	Unit symbol	Value	Description
second	s	03$_h$	*Second*
minute	min	47$_h$	*Minute*
hour	h	48$_h$	*Hour*
day	d	49$_h$	*Day*
year	a	4A$_h$	*Year* (=365.25 days)

Listed in the following table are the possible exponents and their values for 60A8$_h$ (Position unit) and 60A9$_h$ (Speed unit):

Factor	Exponent	Value
10^6	6	06$_h$
10^5	5	05$_h$
...	...	...
10^1	1	01$_h$
10^0	0	00$_h$
10^{-1}	-1	FF$_h$
...	..	...
10^{-5}	-5	FB$_h$
10^{-6}	-6	FA$_h$

10.2.2 Encoder resolution

The physical resolution for position measurement of the used encoder/sensor is calculated from the encoder increments (60E6$_h$ (Encoder Increments)) per motor revolutions (60EB$_h$ (Motor Revolutions)).

10.2.3 Gear ratio

The gear ratio is calculated from motor revolutions (6091$_h$:01) per axis rotation (6091$_h$:02).

10.2.4 Feed constant

The feed constant is calculated in user-defined position units from the feed (6092_h:01) per revolution of the output shaft (6092_h:02).

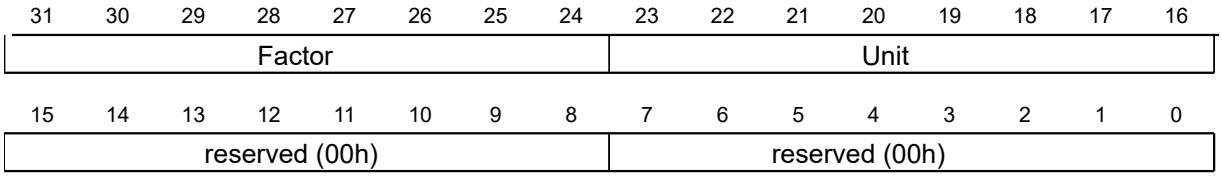
The feed constant is useful for specifying the lead screw pitch for a linear axis and is used if the unit is based on length dimensions or if it is dimensionless.

10.2.5 Calculation formulas for user units

10.2.5.1 Position unit

Object $60A8_h$ contains:

- Bits 16 to 23: The position unit (see chapter Units)
- Bits 24 to 31: The exponent of a power of ten (see chapter Units)



Example

If $60A8_h$ is written with the value "FF410000$_h$" (bits 16-23=41_h and bits 24-31=FF_h), the unit is set to *tenths of degree* (factory setting).

With a relative target position ($607A_h$) of 3600, the motor moves exactly one mechanical revolution, if Gear ratio is 1:1. The Feed constant plays no role in this case.

Example

If $60A8_h$ is written with the value "FD010000$_h$" (bits 16-23=01_h and bits 24-31=FD_h(=-3)), the unit is set to *millimeter*.

With a relative target position ($607A_h$) of 1, the motor moves exactly one mechanical revolution, if Gear ratio and Feed constant are 1:1.

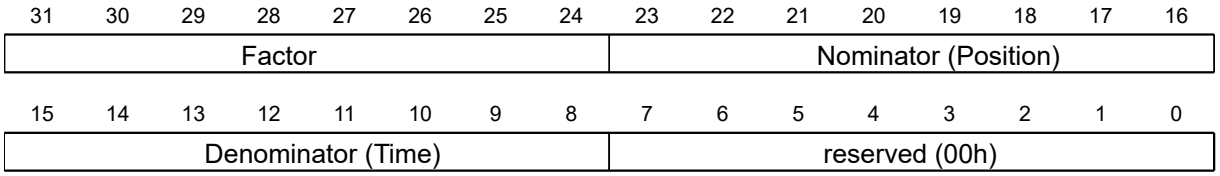
If the Feed constant is set according to the lead screw pitch of a linear axis, the motor turns far enough that a feed of 1 mm is achieved.

Described in chapter Assignment of the feedbacks to the control loops is how you can determine which encoder/sensor is to be used for position control and measurement.

10.2.5.2 Speed unit

Object $60A9_h$ contains:

- Bits 8 to 15: The time unit (see chapter Units)
- Bits 16 to 23: The position unit (see chapter Units)
- Bits 24 to 31: The exponent of a power of ten (see chapter Units)



Example

If 60A9$_h$ is written with the value "00B44700$_h$" (bits 8-15=47$_h$, bits 16-23=B4$_h$ and bits 24-31=00$_h$), the unit is set to *revolutions per minute* (factory setting).

Example

If 60A9$_h$ is written with the value "FD010300$_h$" (bits 8-15=03$_h$, bits 16-23=01$_h$ and bits 24-31=FD$_h$ (=-3), the unit is set to *millimeters per second*.

Described in chapter Assignment of the feedbacks to the control loops is how you can determine which encoder/sensor is to be used for speed control and measurement.

Conversion factor for the speed unit

You can set an additional factor for the speed unit. Thus, a unit of, e.g., 1/3 revolutions/minute is possible. The factor n is calculated from the factor for numerator (6096$_h$:01$_h$) divided by the factor for denominator (6096$_h$:02$_h$).

$$n_{velocity} = \frac{6096_h:01}{6096_h:02}$$

10.2.5.3 Acceleration unit

The acceleration unit is speed unit per second.

Conversion factor for the acceleration unit

The factor n for the acceleration unit is calculated from the numerator (6097$_h$:01$_h$) divided by the denominator (6097$_h$:02$_h$).

$$n_{acceleration} = \frac{6097_h:01}{6097_h:02}$$

10.2.5.4 Jerk unit

The jerk unit is Acceleration unit per second.

Conversion factor for jerk

The factor n for the jerk is calculated from the numerator (60A2$_h$:01$_h$) divided by the denominator (60A2$_h$:02$_h$).

$$n_{jerk} = \frac{60A2_h:01}{60A2_h:02}$$

10.3 Profile Position

10.3.1 Overview

10.3.1.1 Description

Profile Position Mode is used to move to positions relative to the last target position or to an absolute position (last reference position). During the movement, the limit values for the speed, starting acceleration/ braking deceleration and jerks are taken into account.

10.3.1.2 Activation

To activate the mode, the value "1" must be set in object 6060_h (Modes Of Operation) (see "CiA 402 Power State Machine").

10.3.1.3 Controlword

The following bits in object 6040_h (controlword) have a special function:

- Bit 4 starts a travel command. This is carried out on a transition from "0" to "1". An exception occurs if changing from another operating mode to *profile position*: If bit 4 is already set, it does not need to be set to "0" and then back to "1" in order to start the travel command.
- Bit 5: If this bit is set to "1", a travel command triggered by bit 4 is immediately executed. If it is set to "0", the just executed travel command is completed and only then is the next travel command started.
- Bit 6: With "0", the target position ($607A_h$) is absolute and with "1" the target position is relative. The reference position is dependent on bits 0 and 1 of object $60F2_h$.
- Bit 8 (Halt): If this bit is set to "1", the motor stops. On a transition from "1" to "0", the motor accelerates with the set start ramp to the target speed. On a transition from "0" to "1", the motor brakes and comes to a standstill. The braking deceleration is dependent here on the setting of the "Halt Option Code" in object $605D_h$.
- Bit 9 (Change on setpoint): If this bit is set, the speed is not changed until the first target position is reached. This means that, before the first target is reached, no braking is performed, as the motor should not come to a standstill at this position.

Controlword 6040_h		
Bit 9	**Bit 5**	**Definition**
X	1	The new target position is moved to immediately.
0	0	Positioning is completed before moving to the next target position with the new limits.
1	0	The current target position is only passed through; afterwards, the new target position is moved to with the new values.

For further information, see figure in "Setting travel commands".

NOTICE

Bit 9 in the controlword is ignored if the ramp speed is not met at the target point. In this case, the controller would need to reset and take a run-up to reach the preset.

10.3.1.4 Statusword

The following bits in object 6041_h (statusword) have a special function:

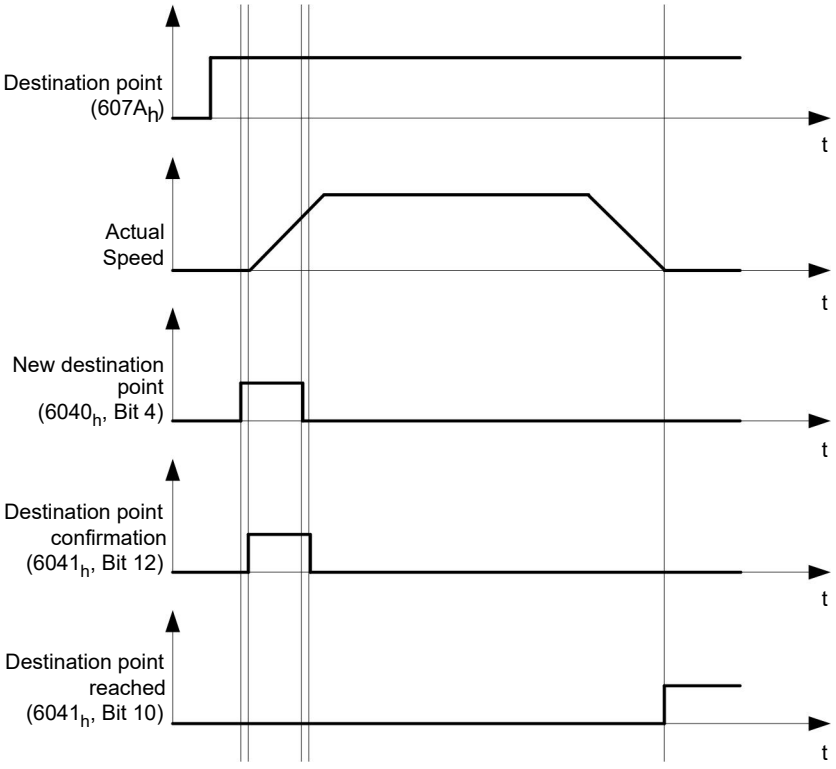
- Bit 10 (Target Reached): This bit is set to "1" if the last target was reached and the motor remains within a tolerance window (6067_h) for a preset time (6068_h). The bit is also set to "1" if the halt bit (bit 8) in 6040_h has been set and as soon as the motor is at a standstill.
- Bit 11: Limit exceeded: The demand position is above or below the limit values set in $607D_h$.

- Bit 12 (Set-point acknowledge): This bit confirms receipt of a new and valid set point. It is set and reset in sync with the "New set-point" bit in the controlword.
  There is an exception in the event that a new movement is started before another one has completed and the next movement is not to occur until after the first one has finished. In this case, the bit is reset if the command was accepted and the controller is ready to execute new travel commands. If a new travel command is sent even though this bit is still set, the newest travel command is ignored.
  The bit is not set if one of the following conditions is met:
  - The new target position can no longer be reached while adhering to all boundary conditions.
  - A target position was already traveled to and a target position was already specified. A new target position can only be specified after the current positioning has been concluded.
- Bit 13 (Following Error): This bit is set in *closed loop* mode if the following error is greater than the set limits (6065_h (Following Error Window) and 6066_h (Following Error Time Out)).

10.3.2 Setting travel commands

10.3.2.1 Travel command

In object $607A_h$ (Target Position), the new target position is specified in user units (see User-defined units). The travel command is then triggered by setting bit 4 in object 6040_h (controlword). If the target position is valid, the controller responds with bit 12 in object 6041_h (statusword) and begins the positioning move. As soon as the position is reached, bit 10 in the statusword is set to "1".



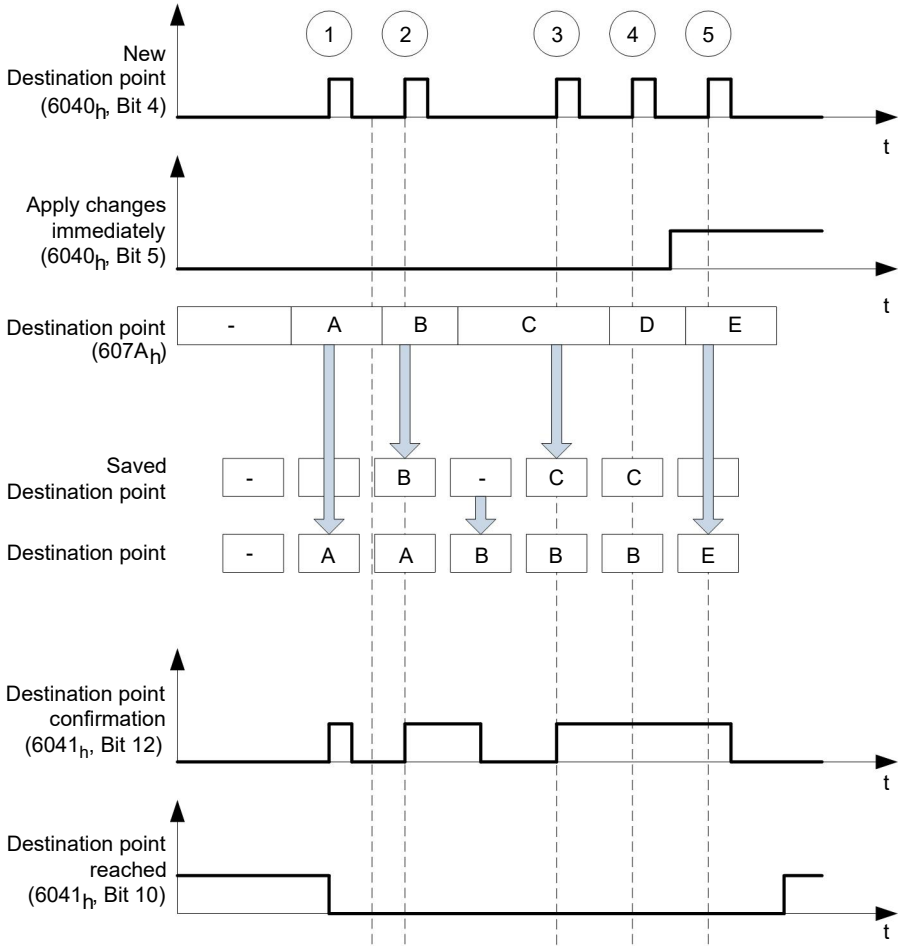
The controller can also reset bit 4 in object 6040_h (controlword) on its own. This is set with bits 4 and 5 of object $60F2_h$.

10.3.2.2 Other travel commands

Bit 12 in object 6041_h (statusword, set-point acknowledge) changes to "0" if another travel command can be buffered (see time 1 in the following figure). As long as a target position is being moved to, a second target position can be passed to the controller in preparation. All parameters – such as speed, acceleration, braking deceleration, etc. – can thereby be reset (time 2). If the buffer is empty, the next time can be queued up (time 3).

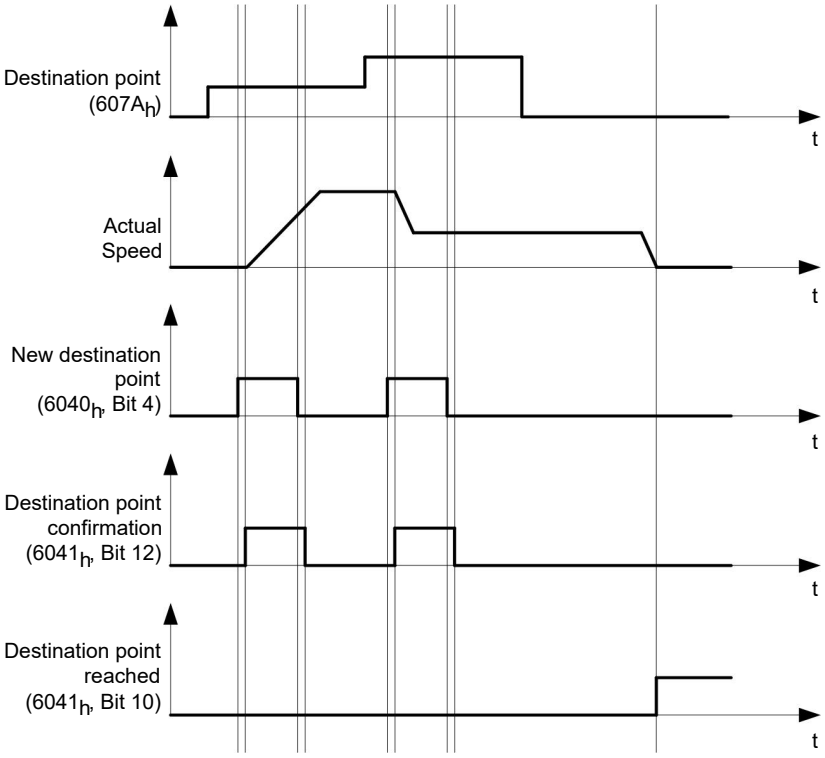
If the buffer is already full, a new set point is ignored (time 4). If bit 5 in object 6040_h (controlword, bit: "Change Set-Point Immediately") is set, the controller operates without the buffer; new travel commands are implemented directly (time 5).

Times



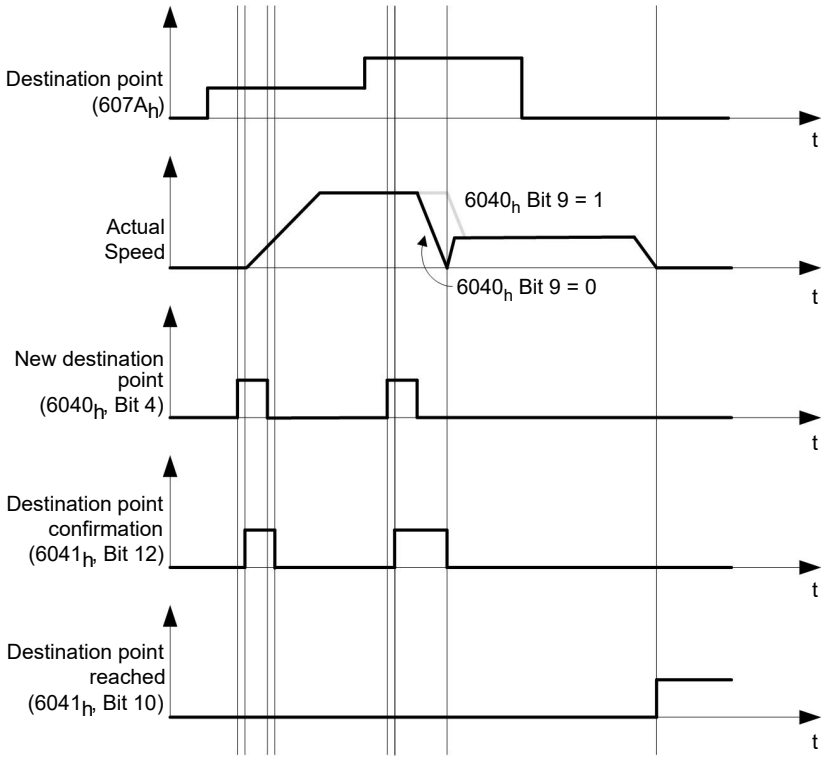
Transition procedure for second target position

The following graphic shows the transition procedure for the second target position while moving to the first target position. In this figure, bit 5 of object 6040h (controlword) is set to "1"; the new target value is, thus, taken over immediately.



Possibilities for moving to a target position

If bit 9 in object 6040$_h$ (controlword) is equal to "0", the current target position is first moved to completely. In this example, the final speed (6082$_h$) of the target position is equal to zero. If bit 9 is set to "1", the profile speed (6081$_h$) is maintained until the target position is reached; only then do the new boundary conditions apply.



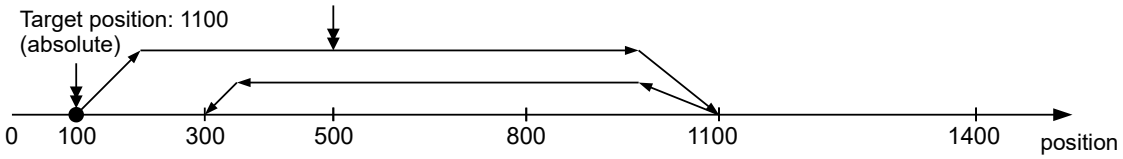
Possible combinations of travel commands

To provide a better overview of the travel commands, combinations of travel commands are listed and depicted in this chapter.

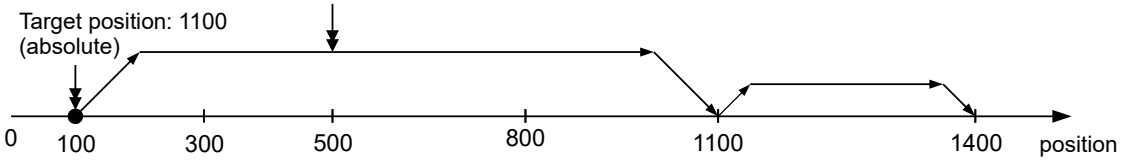
The following applies for the figures below:

- A double arrow indicates a new travel command.
- The first travel command at the start is always an absolute travel command to position 1100.
- The second movement is performed at a lower speed so as to present the graphs in a clear manner.

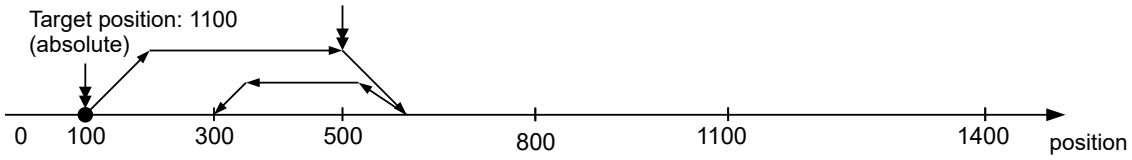
- Change on setpoint (6040_h:00 Bit 5 = 0)
- Move absolute (6040_h:00 Bit 6 = 0)
- Target position: 300



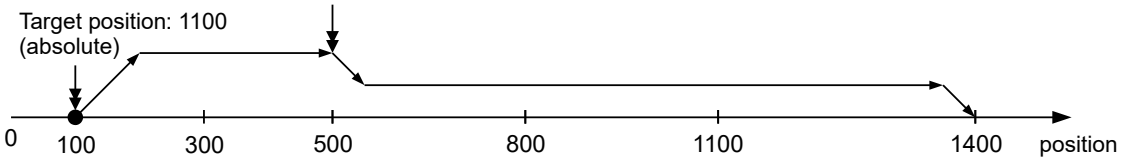
- Relative to the preceding target position ($60F2_h$:00 = 0)
- Change on setpoint (6040_h:00 Bit 5 = 0)
- Move relative (6040_h:00 Bit 6 = 1)
- Target position: 300

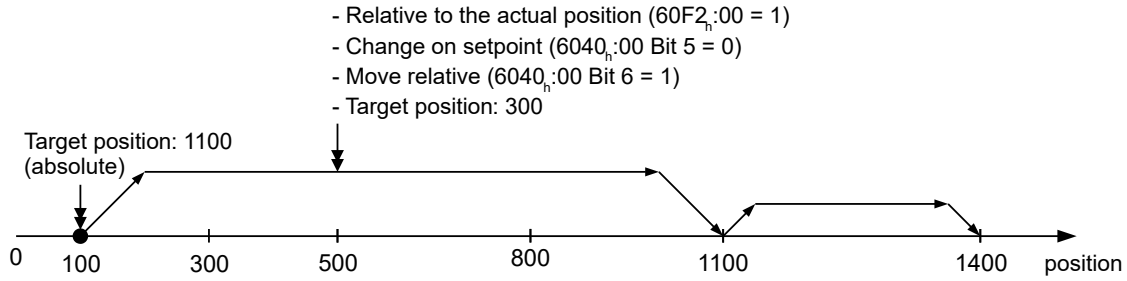


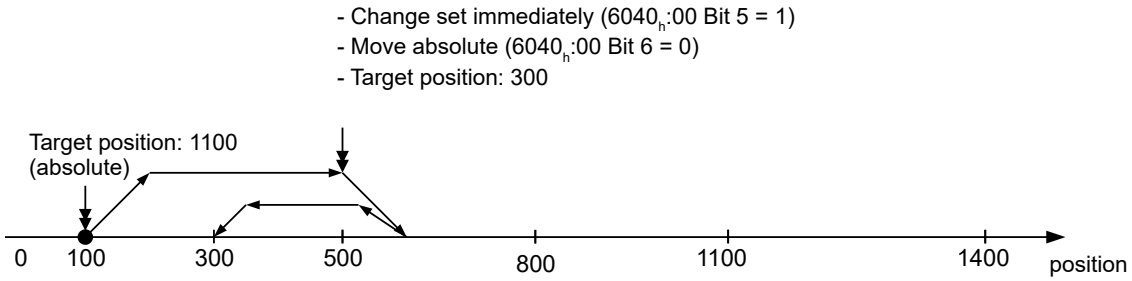
- Change set immediately (6040_h:00 Bit 5 = 1)
- Move absolute (6040_h:00 Bit 6 = 0)
- Target position: 300

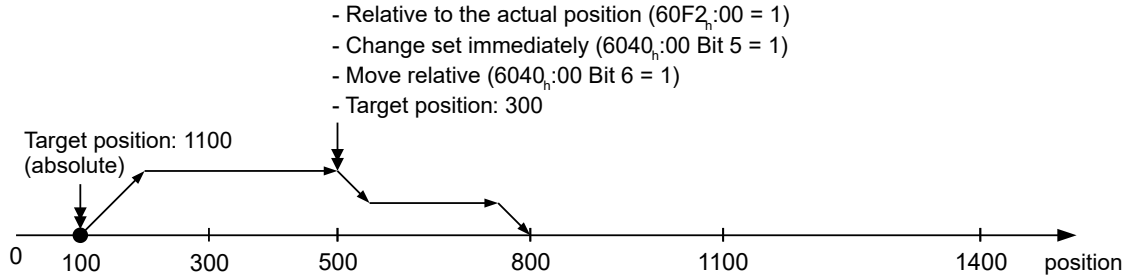


- Relative to the preceding target position ($60F2_h$:00 = 0)
- Change set immediately (6040_h:00 Bit 5 = 1)
- Move relative (6040_h:00 Bit 6 = 1)
- Target position: 300



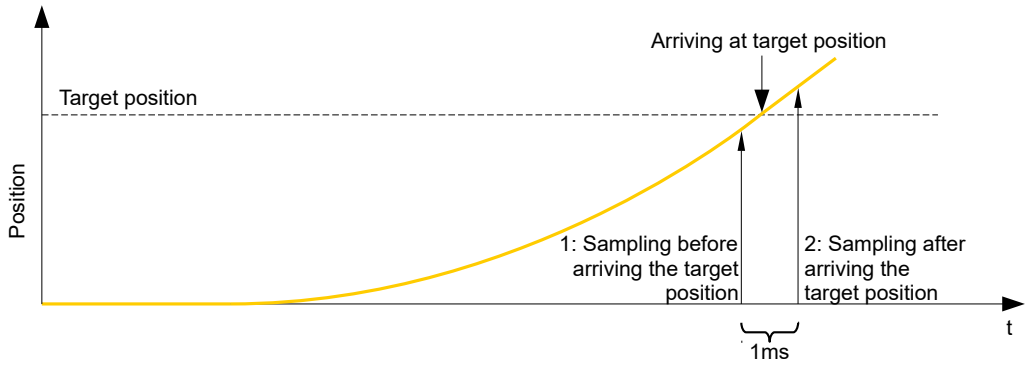






10.3.3 Loss of accuracy for relative movements

When linking together relative movements, a loss of accuracy may occur if the final speed is not set to zero. The following graphic illustrates the reason.



The current position is sampled once per millisecond. It is possible that the target position is reached between two samples. If the final speed is not equal to zero, then, after the target position is reached, the sample is used as an offset as the basis for the subsequent movement. As a result, the subsequent movement may go somewhat farther than expected.

10.3.4 Boundary conditions for a positioning move

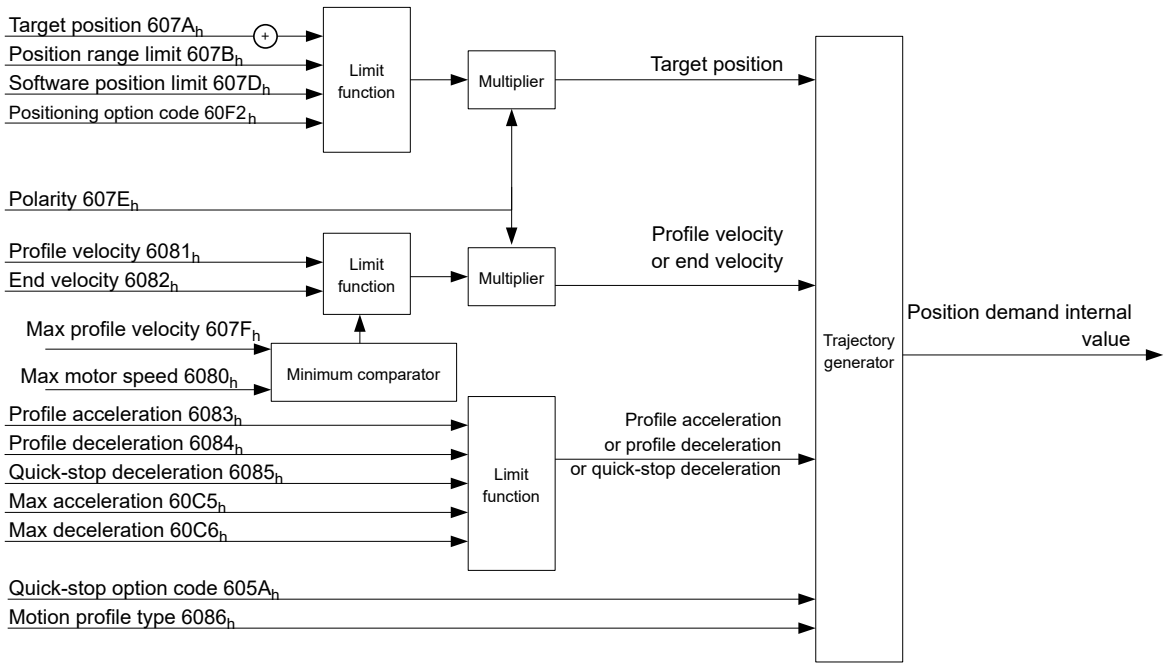
10.3.4.1 Object entries

The boundary conditions for the position that has been moved to can be set in the following entries of the object dictionary:

- 607A$_h$: (Target Position): Planned target position
- 607D$_h$: (Software Position Limit): Definition of the limit stops (see chapter Software limit switches)
- 607C$_h$ (Home Offset): Specifies the difference between the zero position of the controller and the reference point of the machine in user-defined units. (See "Homing")
- 607B$_h$ (Position Range Limit): Limits of a modulo operation for replicating an endless rotation axis
- 607$_h$ (Polarity): Direction of rotation
- 6081$_h$ (Profile Velocity): Maximum speed with which the position is to be approached
- 6082$_h$ (End Velocity): Speed upon reaching the target position
- 6083$_h$ (Profile Acceleration): Desired starting acceleration
- 6084$_h$ (Profile Deceleration): Desired braking deceleration
- 6085$_h$ (Quick Stop Deceleration): Emergency-stop braking deceleration in case of the "Quick stop active" state of the "CiA 402 Power State Machine"
- 6086$_h$ (Motion Profile Type): Type of ramp to be traveled; if the value is "0", the jerk is not limited; if the value is "3", the values of 60A4$_h$:1$_h$–4$_h$ are set as limits for the jerk.
- 60C5$_h$ (Max Acceleration): The maximum acceleration that may not be exceeded when moving to the end position
- 60C6$_h$ (Max Deceleration): The maximum braking deceleration that may not be exceeded when moving to the end position
- 60A4$_h$ (Profile Jerk), subindex 01$_h$ to 04$_h$: Objects for specifying the limit values for the jerk.
- The speed is is limited by 607F$_h$ (Max Profile Velocity) and 6080$_h$ (Max Motor Speed); the smaller value is used as the limit.
- 60F2$_h$: (Positioning Option Code): Defines the positioning behavior

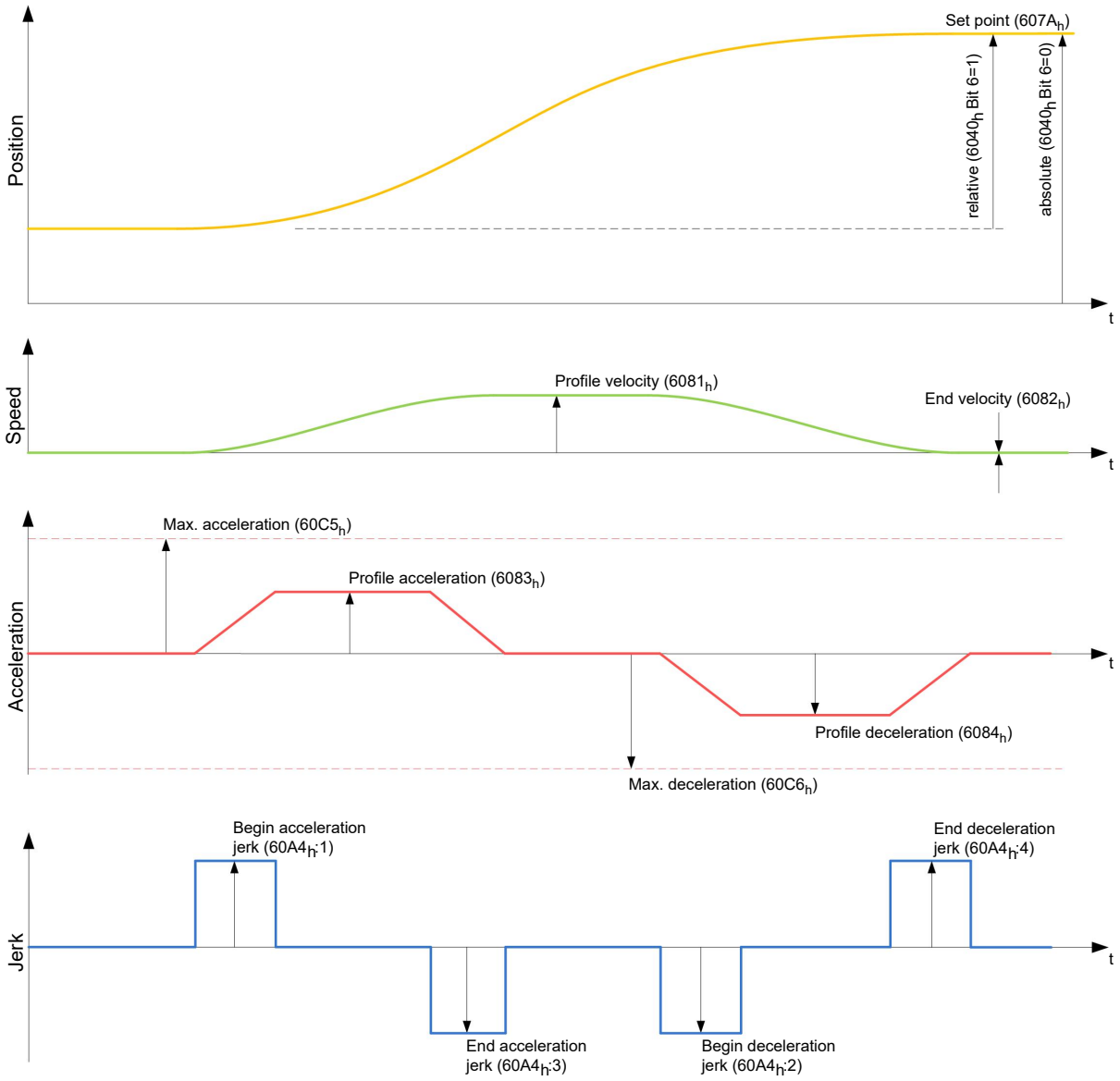
10.3.4.2 Objects for the positioning move

The following graphic shows the objects involved in the boundary conditions of the positioning move.



10.3.4.3 Parameters for the target position

The following graphic shows an overview of the parameters that are used for moving to a target position (figure not to scale).



10.3.5 Jerk-limited mode and non-jerk-limited mode

10.3.5.1 Description

A distinction is made between the "jerk-limited" and "non-jerk-limited" modes.

10.3.5.2 Jerk-limited mode

Jerk-limited positioning can be achieved by setting object 6086$_h$ to "3". The entries for the jerks in subindices :1$_h$–4$_h$ of object 60A4 thereby become valid.

10.3.5.3 Non-jerk-limited mode

A "non-jerk-limited" ramp is traveled if the entry in object 6086$_h$ is set to "0" (default setting).

10.4 Velocity

10.4.1 Description

This mode operates the motor at a preset target speed, similar to a frequency inverter. Unlike the *profile velocity mode*, this mode does not permit the selection of jerk-limited ramps.

10.4.2 Activation

To activate the mode, the value "2" must be set in object 6060_h (Modes Of Operation) (see "CiA 402 Power State Machine").

10.4.3 Controlword

The following bits in object 6040_h (controlword) have a special function:

- Bit 8 (Halt): If this bit is set to "1", the motor stops. On a transition from "1" to "0", the motor accelerates with the acceleration ramp to the target speed. On a transition from "0" to "1", the motor brakes according to the deceleration ramp and comes to a standstill.

10.4.4 Statusword

The following bits in object 6041_h (statusword) have a special function:

- Bit 11: Limit exceeded: The target speed is above or below the set limit values.

10.4.5 Object entries

The following objects are necessary for controlling this mode:

- $604C_h$ (Dimension Factor):
  The unit for speed values is defined here for the following objects.
  Subindex 1 contains the denominator (multiplier) and subindex 2 contains the numerator (divisor) with which the internal speed values are converted to revolutions per minute. If, for example, subindex 1 is set to the value "60" and subindex 2 is set to the value "1", the speed is specified in revolutions per second (60 revolutions per 1 minute).
- 6042_h: Target Velocity.
  The target speed is set here in user-defined units.
- 6048_h: Velocity Acceleration
  This object defines the acceleration. Subindex 1 contains the change in speed, subindex 2 the corresponding time in seconds. Both together are used to calculate the acceleration:

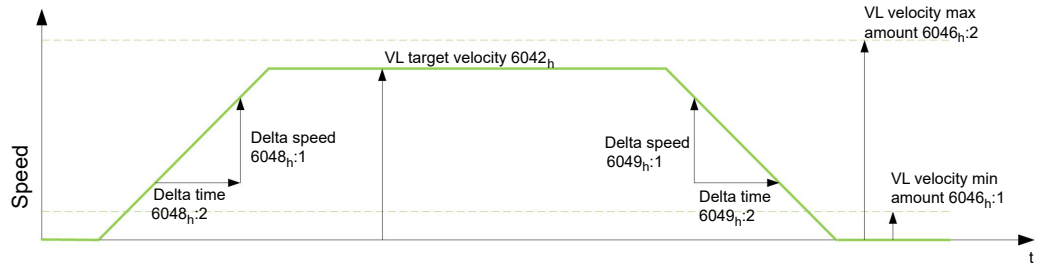
$$\text{VL velocity acceleration} = \frac{\text{Delta speed } (6048_h{:}1)}{\text{Delta time } (6048_h{:}2)}$$

- 6049_h (Velocity Deceleration):
  This object defines the deceleration (deceleration ramp). The subindices here are arranged as described in object 6048_h; the change in speed is to be specified with positive sign.
- 6046_h (Velocity Min Max Amount):
  The limitations of the target speeds are specified in this object.
  The minimum speed is set in $6046_h{:}1_h$. If the target speed (6042_h) falls below the minimum speed, the value is limited to the minimum speed $6046_h{:}1_h$.
  The maximum speed is set in $6046_h{:}2_h$. If the target speed (6042_h) exceeds the maximum speed, the value is limited to the maximum speed $6046_h{:}2_h$.
- $604A_h$ (Velocity Quick Stop):
  This object can be used to set the quick-stop ramp. Subindices 1 and 2 are identical to those described for object 6048_h.

The following objects can be used to check the function:

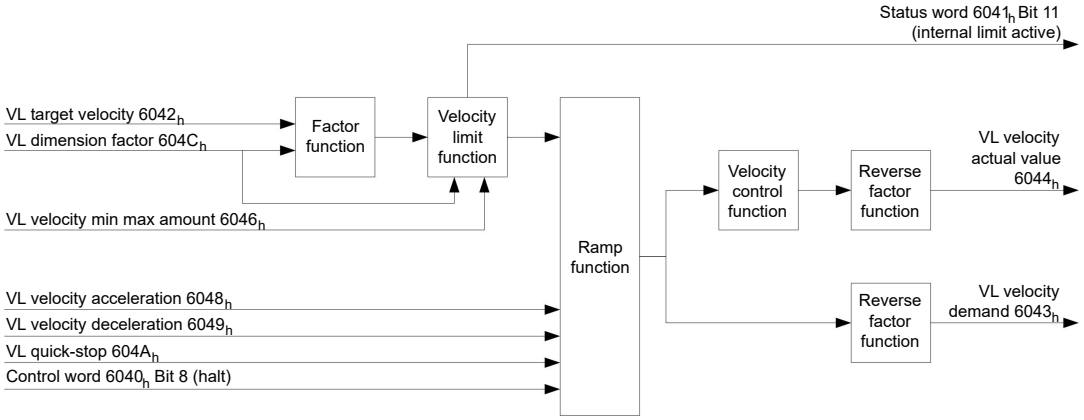
- 6043_h (Vl Velocity Demand)
- 6044_h (Vl Velocity Actual Value)

10.4.5.1 Speeds in Velocity Mode



10.4.5.2 Objects for Velocity Mode

The ramp generator follows the target speed, remaining within the set speed and acceleration limits. As long as a limit is active, bit 11 in object 6041h is set (internal limit active).



10.5 Profile Velocity

10.5.1 Description

This mode operates the motor in Velocity Mode with extended (jerk-limited) ramps.

10.5.2 Activation

To activate the mode, the value "3" must be set in object 6060h (Modes Of Operation) (see "CiA 402 Power State Machine").

10.5.3 Controlword

The following bits in object 6040h (controlword) have a special function:

- Bit 8 (Halt): If this bit is set to "1", the motor stops. On a transition from "1" to "0", the motor accelerates with the set start ramp to the target speed. On a transition from "0" to "1", the motor brakes and comes to a standstill.

10.5.4 Statusword

The following bits in object 6041h (statusword) have a special function:

- Bit 10 (target speed reached; Target Reached): In combination with bit 8 in the controlword, this bit specifies whether the target speed is reached, if braking is taking place or if the motor is at a standstill (see table).

6041h Bit 10	6040h Bit 8	Description
0	0	Target speed not reached

6041_h Bit 10	6040_h Bit 8	Description
0	1	Axis braking
1	0	Target speed within target window (defined in $606D_h$h and $606E_h$)
1	1	Axis speed is 0

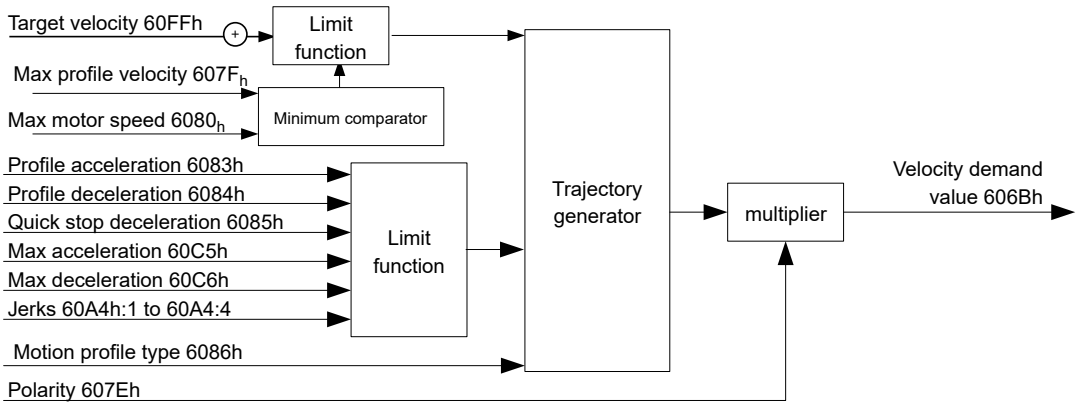
- Bit 12: This bit indicates whether the actual speed is zero.
  If the actual speed is greater than the value in $606F_h$(Velocity Threshold) for a time of 6070_h(Velocity Threshold Time), this bit has the value "0". The bit otherwise remains set to "1".
- Bit 13 (Deviation Error): This bit is set in *closed loop* mode if the slippage error is greater than the set limits (60F8h Max Slippage and 203Fh Max Slippage Time Out).

10.5.5 Object entries

The following objects are necessary for controlling this mode:

- $606B_h$ (Velocity Demand Value):
  This object contains the output of the ramp generator, which simultaneously serves as the preset value for the velocity controller.
- $606C_h$ (Velocity Actual Value):
  Indicates the current actual speed.
- $606D_h$ (Velocity Window):
  This value specifies by how much the actual speed may vary from the set speed for bit 10 (target speed reached; Target Reached") in object 6041_h (statusword) to be set to "1".
- $606E_h$ (Velocity Window Time):
  This object specifies how long the actual speed and the set speed must be close to one another (see $606D_h$ "Velocity Window") for bit 10 "Target speed reached" in object 6041_h (statusword) to be set to "1".
- $607E_h$ (Polarity):
  If bit 6 is set to "1" here, the sign of the target speed is reversed.
- 6083_h (Profile acceleration):
  Sets the value for the acceleration ramp.
- 6084_h (Profile Deceleration):
  Sets the value for the deceleration ramp.
- 6085_h (Quick Stop Deceleration):
  Sets the value for the deceleration ramp for rapid braking.
- 6086_h (Motion Profile Type):
  The ramp type can be selected here ("0" = trapezoidal ramp, "3" = jerk-limited ramp).
- $60FF_h$ (Target Velocity):
  Specifies the target speed that is to be reached.
- The speed is is limited by $607F_h$ (Max Profile Velocity) and 6080_h (Max Motor Speed); the smaller value is used as the limit.

10.5.5.1 Objects in Profile Velocity Mode

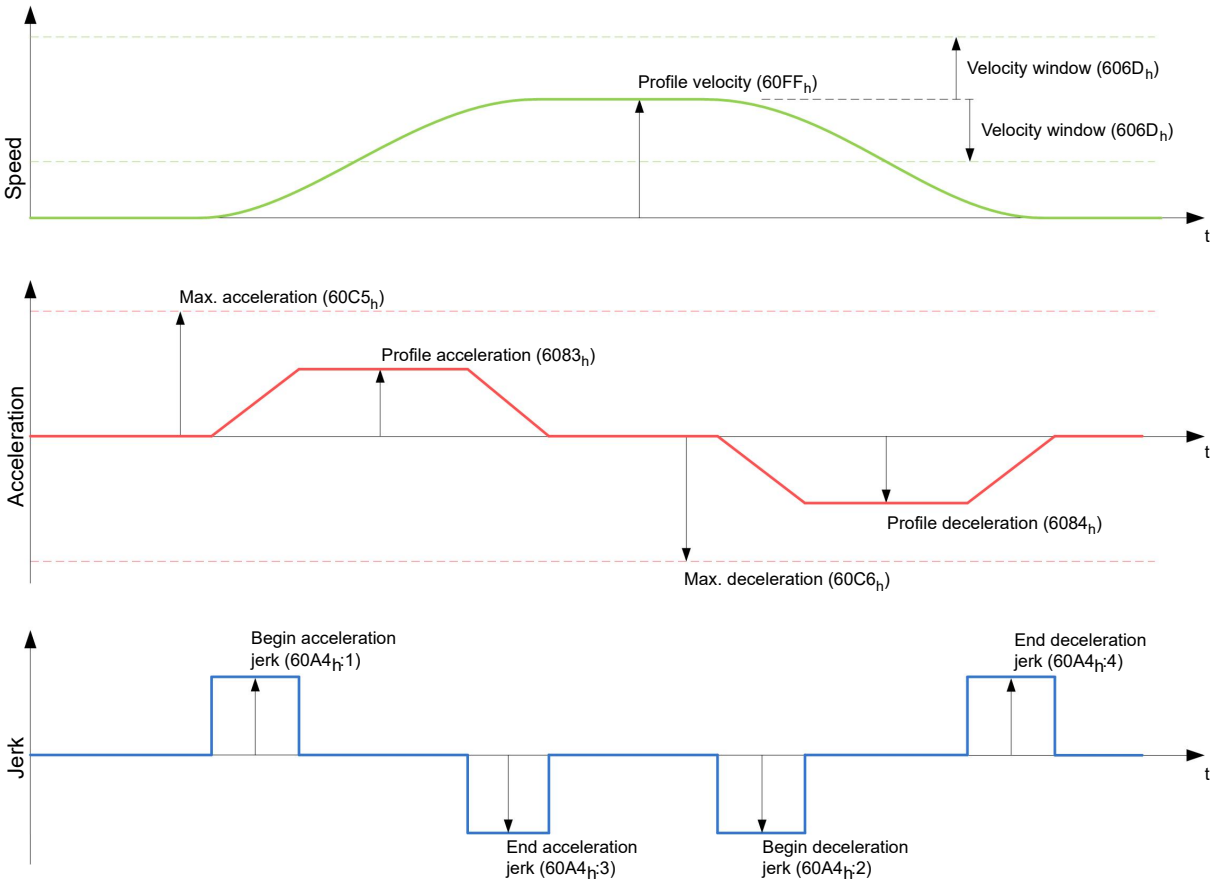


10.5.5.2 Activation

After the mode is selected in object 6060h (Modes Of Operation) and the "Power State machine" (see "CiA 402 Power State Machine") is switched to *Operation enabled*, the motor is accelerated to the target speed in object 60FFh (see following figures). The speed and acceleration values are taken into account here; for jerk-limited ramps, the jerk-limit values are also taken into account.

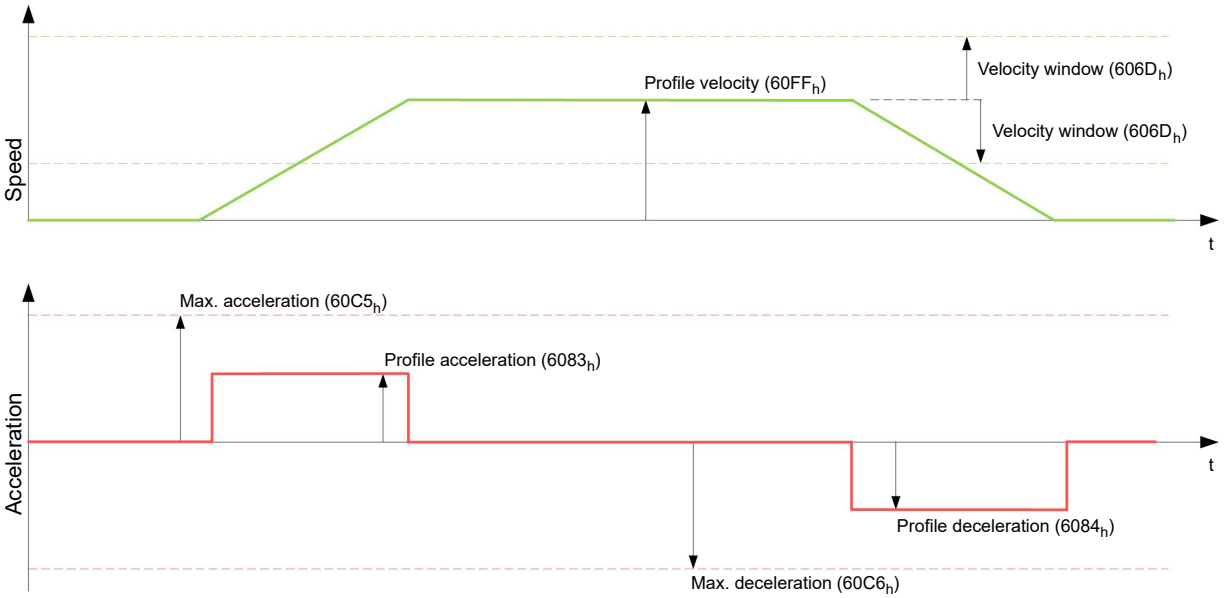
10.5.5.3 Limitations in the jerk-limited case

The following figure shows the adjustable limits in the jerk-limited case (6086h = 3).



10.5.5.4 Limitations in the trapezoidal case

This figure shows the adjustable limitations for the trapezoidal case (6086_h = 0).



10.6 Profile Torque

10.6.1 Description

In this mode, the torque is preset as a set value and reached via a ramp function.

NOTICE

This mode only functions if closed loop is activated, see also Commissioning Closed Loop.

10.6.2 Activation

To activate the mode, the value "4" must be set in object 6060_h (Modes Of Operation) (see "CiA 402 Power State Machine").

10.6.3 Controlword

The following bits in object 6040_h (controlword) have a special function:

- Bit 8 (Halt): If this bit is set to "1", the motor stops. If this bit is set from "1" to "0", the motor is started up according to the presets. When setting from "0" to "1", the motor is again brought to a standstill, taking the preset values into consideration.

10.6.4 Statusword

The following bits in object 6041_h (statusword) have a special function:

- Bit 10 (Target Reached): In combination with bit 8 of object 6040_h (controlword), this bit indicates whether the specified torque is reached (see following table). The target is considered having been met if the current torque (6077h Torque Actual Value) is within a tolerance window (203Dh Torque Window) for a specified time (203Eh Torque Window Time Out).

6040_h Bit 8	6041_h Bit 10	Description
0	0	Specified torque not reached

6040_h Bit 8	6041_h Bit 10	Description
0	1	Specified torque reached
1	0	Axis brakes
1	1	Axis speed is 0

- Bit 11: Limit exceeded: The target torque (6071_h) exceeds the maximum torque entered in 6072_h.

10.6.5 Object entries

All values of the following entries in the object dictionary are to be specified as a thousandth of the maximum torque, which corresponds to the rated current (6075_h). This includes the objects:

- 6071_h (Target Torque):
  Target torque
- 6072_h (Max Torque):
  Maximum torque during the entire ramp (accelerate, maintain torque, decelerate)
- 6073_h (Max Current):
  Maximum current. The minimum of 6073_h and 6072_h is used as limit for the torque in 6071_h.
- 6074_h (Torque Demand):
  Current output value of the ramp generator (torque) for the controller
- 6077 (Torque Actual Value):
  Current torque value
- 6087_h (Torque Slope):
  Max. change in torque per second

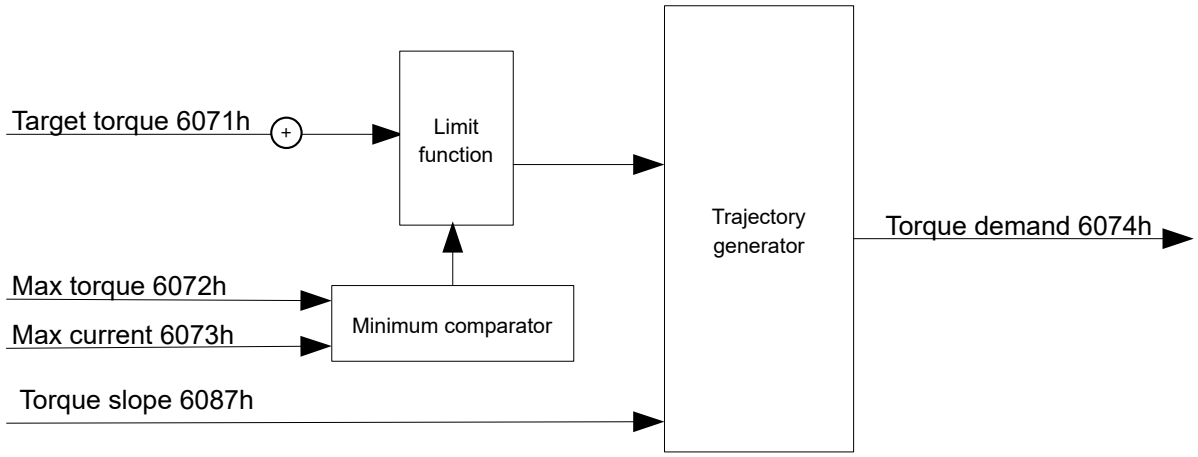
NOTICE

These values are not limited to 100% of the rated current (6075_h). Torque values greater than the rated torque (generated from the rated current) can be achieved if the maximum duration (3219_h:01_h) of the maximum current (6073_h) is set (see I2t Motor overload protection).

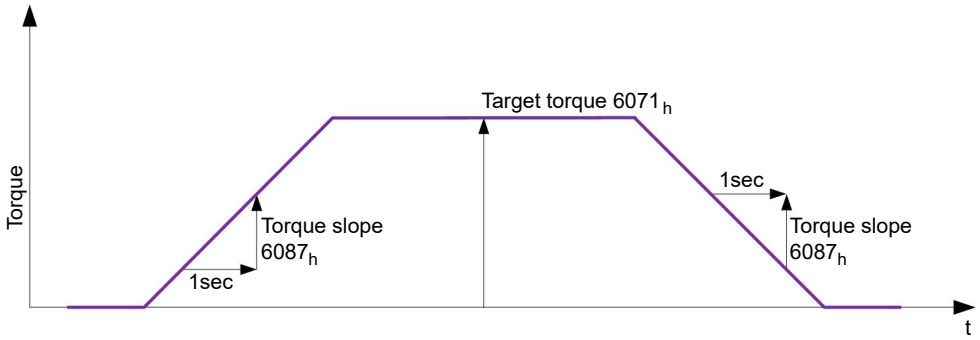
The following objects are also needed for this operating mode:

- 3202_h Bit 5 (Motor Drive Submode Select):
  If this bit is set to "0", the drive controller is operated in the torque-limited Velocity Mode, i.e., the maximum speed can be limited in objects $607F_h$ and 6080_h and the controller can operate in field weakening mode.
  If this bit is set to "1", the controller operates in the ("Real") Torque Mode; the maximum speed cannot be limited here and field weakening mode is not possible.

10.6.5.1 Objects of the ramp generator



10.6.5.2 Torque curve



10.7 Homing

10.7.1 Overview

10.7.1.1 Description

The purpose of the homing method is to align the position zero point of the controller with an encoder index or position switch.

10.7.1.2 Activation

To activate the mode, the value "6" must be set in object 6060h (Modes Of Operation) (see "CiA 402 Power State Machine").

TIP

If home switches and/or limit switches are used, you must first assign these special functions to the desired input in the I/O configuration (see "Digital inputs and outputs").

To use the limit switch, you must also set object 3701h to "-1" (factory setting) to prevent blocking the further travel of the motor.

10.7.1.3 Controlword

The following bits in object 6040h (controlword) have a special function:

- Bit 4: If the bit is set to "1", referencing is started. This is performed until either the reference position is reached or bit 4 is reset to "0".

10.7.1.4 Statusword

The following bits in object 6041$_h$ (statusword) have a special function:

Bit 13	Bit 12	Bit 10	Description
0	0	0	Homing is performed
0	0	1	Homing is interrupted or not started
0	1	0	Homing has been performed since the last restart but target is not currently reached
0	1	1	Homing completed
1	0	0	Error during homing, motor still turning
1	0	1	Error during homing, motor at standstill

NOTICE

Bit 12 in *Homing* mode is set to 1 after the first fully completed homing operation since the restart. It is only reset to 0

- during all subsequent homing operations
- in the event of an error during a homing operation (permanently deleted until a new homing operation is fully completed).

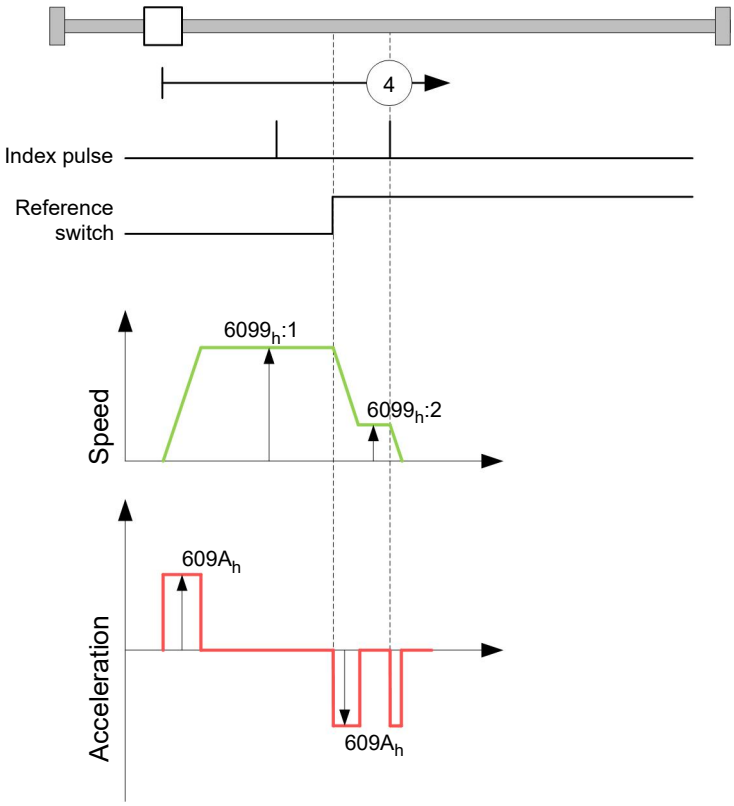
10.7.1.5 Object entries

The following objects are necessary for controlling this mode:

- 607C$_h$ (Home Offset): Specifies the difference between the zero position of the controller and the reference point of the machine in user-defined units.
- 6098$_h$ (Homing Method):
  Method to be used for referencing (see "Homing method")
- 6099$_h$:01$_h$ (Speed During Search For Switch):
  Speed for the search of the switch
- 6099$_h$:02$_h$ (Speed During Search For Zero):
  Speed for the search of the index
- 6080$_h$ (Max Motor Speed): Maximum speed
- 609A$_h$ (Homing Acceleration):
  Starting acceleration and braking deceleration for homing
- 3219$_h$:05$_h$ (Block Detection Threshold):
  Minimum current threshold which, if exceeded, is to detect the blocking of the motor at a block.
- 3219$_h$:04$_h$ (Block Detection Time):
  Specifies the time in ms that the motor is to continue to run against the block after block detection.

Homing speeds

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



10.7.2 Homing method

10.7.2.1 Description

The homing method is written as a number in object 6098h and decides whether, on a switch edge (rising/ falling), a current threshold for block detection or an index pulse is referenced or in which direction homing starts. Methods that use the index pulse of the encoder lie in the number range 1 to 14, 33 and 34. Methods that do not use the index pulse of the encoder lie between 17 and 30, but are identical to methods 1 to 14 with respect to the travel profiles. These number are shown in circles in the following figures. Methods for which no limit switches are used and, instead, travel against a block is to be detected, a minus must be placed before the method number when making the call.

In the following graphics, the negative movement direction is to the left. The *limit switch* is located before the respective mechanical block; the *home switch* is located between the two limit switches. The index pulses come from the connected encoder.

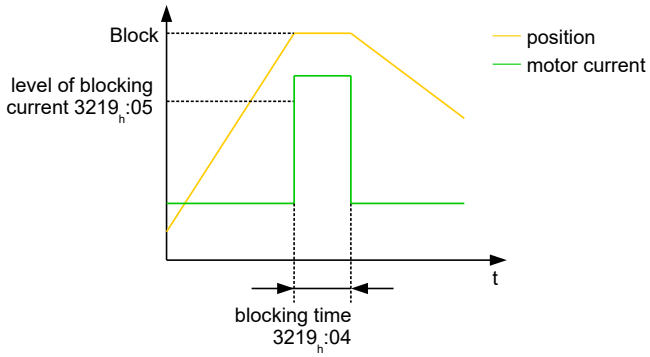
For methods that use homing on block, the same figures apply as for the methods with limit switch. Because nothing is different aside from the missing limit switches, the same figures are used. For the figures here, the limit switches must be replaced with a mechanical block.

10.7.2.2 Homing on block

Homing on block currently only functions in *closed loop* mode.

"Homing on block" functions like every homing method with the difference that instead of a limit switch, a block (limit stop) is used for positioning. Two settings are to be made here:

1. Current level: In object 3219h:05, the current level is defined above which movement against the block is detected.
2. Blocking duration: In object 3219h:04, the duration during which the motor moves against the block is set.



There is one exception for methods −17 and −18: after reaching the block, the direction is not reversed, but the motor remains energized in its position.

10.7.2.3 Overview of methods

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

Methods 17 to 32 are identical to methods 1 to 14 with the difference that only limit or home switches are used for referencing and not the index pulse.

- Methods 1 to 14 use an index pulse.
- Methods 17 to 30 do not use an index pulse.
- Methods 33 and 34 reference only to the next index pulse.
- Method 37 references to the current position.

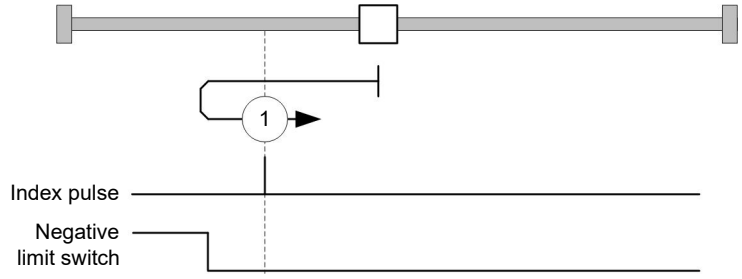
The following methods can be used for homing on block:

- Methods -1 to -2 and -7 to -14 contain an index pulse
- Methods -17 to -18 and -23 to -30 have no index pulse

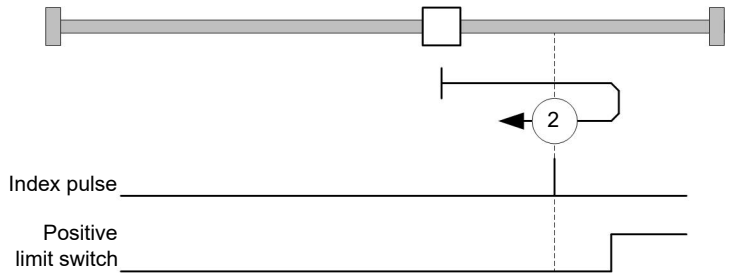
10.7.2.4 Methods 1 and 2

Reference to limit switches and index pulse.

Method 1 references to negative limit switch and index pulse:



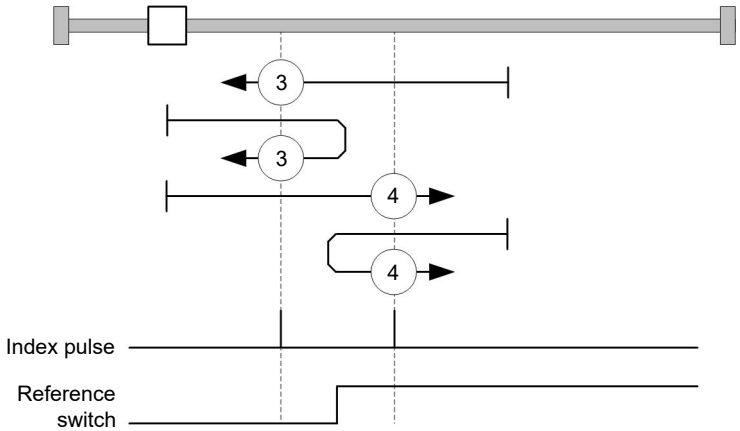
Method 2 references to positive limit switch and index pulse:



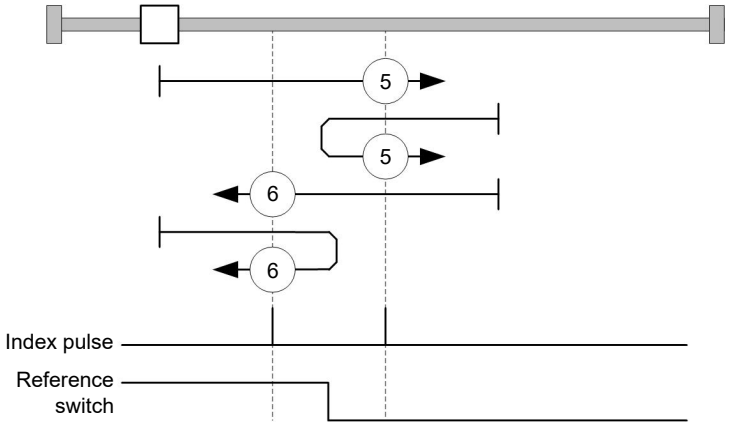
10.7.2.5 Methods 3 to 6

Reference to the switching edge of the home switch and index pulse.

With methods 3 and 4, the left switching edge of the home switch is used as reference:



With methods 5 and 6, the right switching edge of the home switch is used as reference:

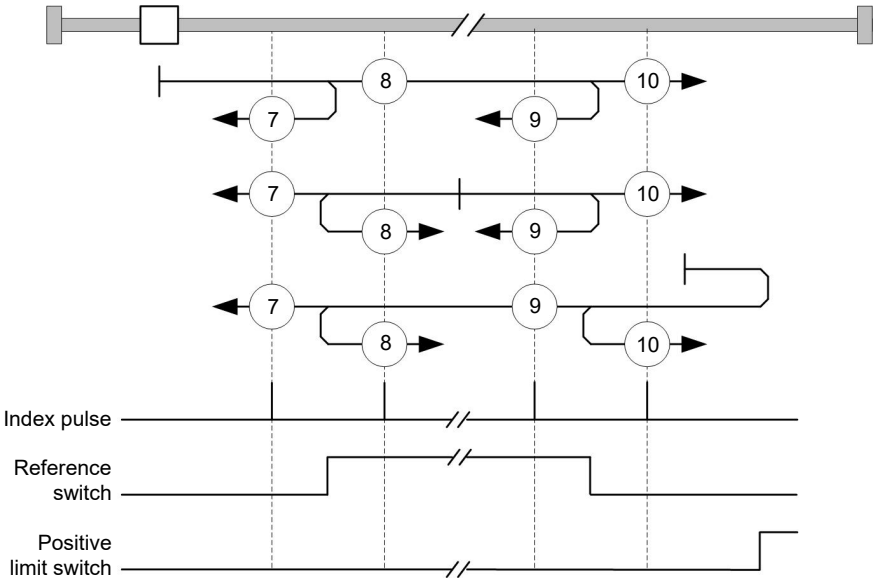


10.7.2.6 Methods 7 to 14

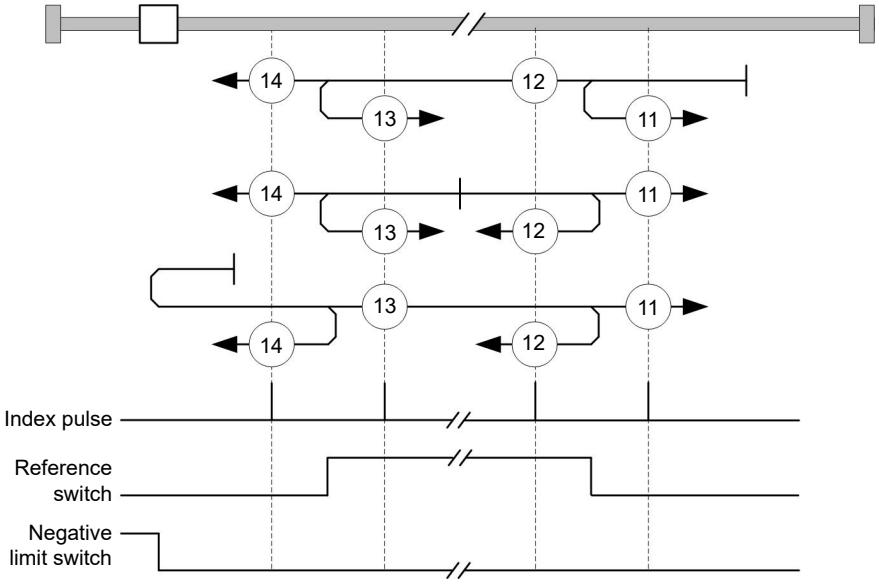
Reference to the home switch and index pulse (with limit switches).

With these methods, the current position relative to the home switch is not important. With method 10, for example, referencing is always performed to the index pulse to the right of the right edge of the home switch.

Methods 7 to 10 take the positive limit switch into account:



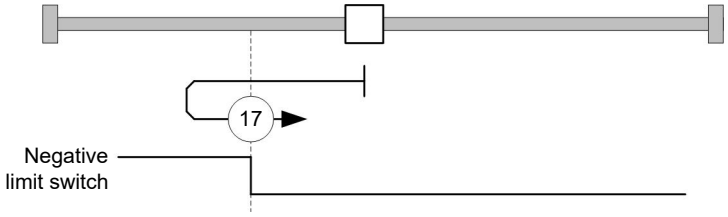
Methods 11 to 14 take the negative limit switch into account:



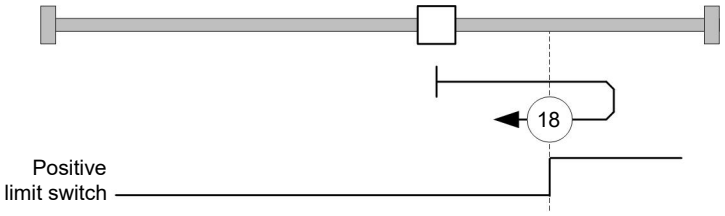
10.7.2.7 Methods 17 and 18

Reference to the limit switch without the index pulse.

Method 17 references to the negative limit switch:



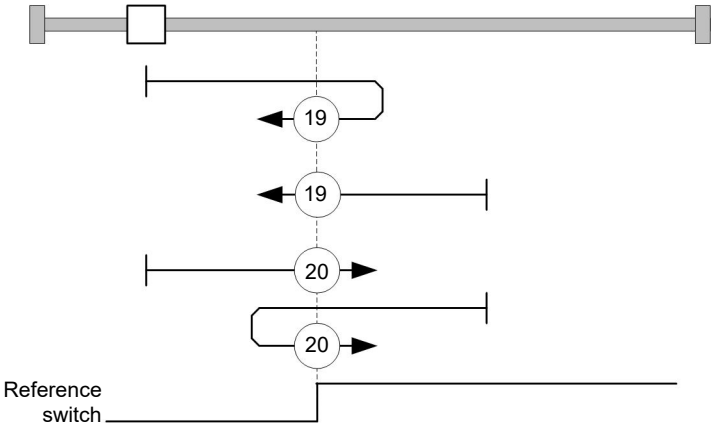
Method 18 references to the positive limit switch:



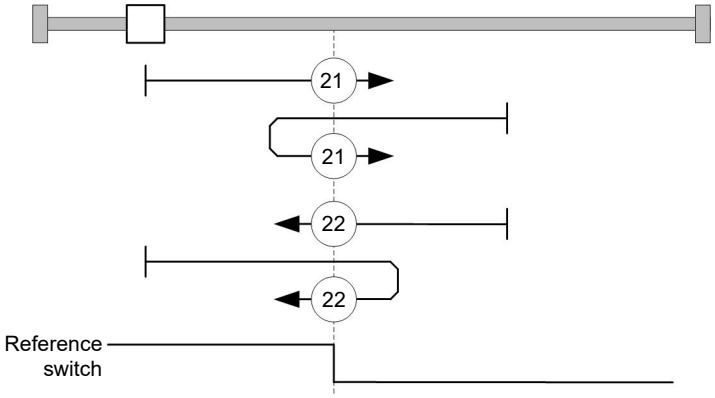
10.7.2.8 Methods 19 to 22

Reference to the switching edge of the home switch without the index pulse.

With methods 19 and 20 (equivalent to methods 3 and 4), the left switching edge of the home switch is used as reference:



With methods 21 and 22 (equivalent to methods 5 and 6), the right switching edge of the home switch is used as reference:

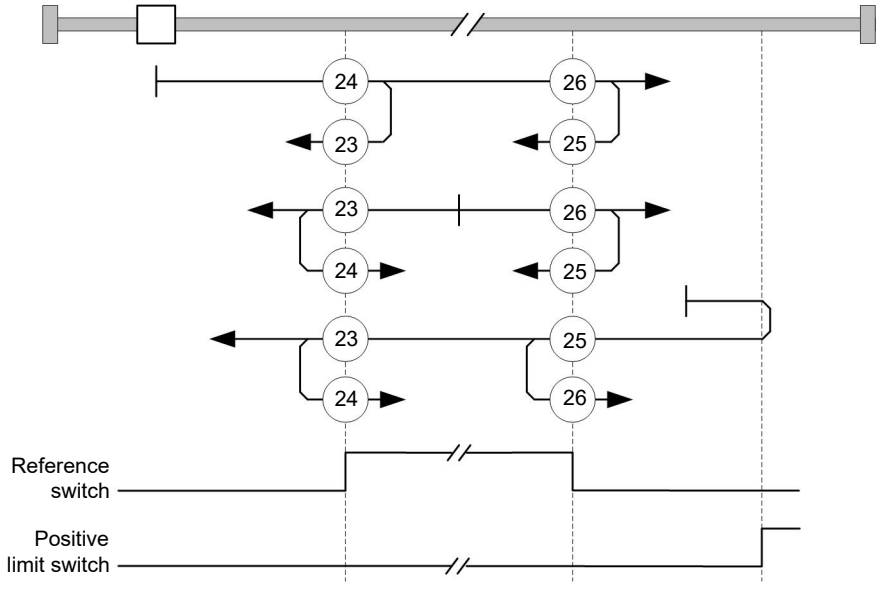


10.7.2.9 Methods 23 to 30

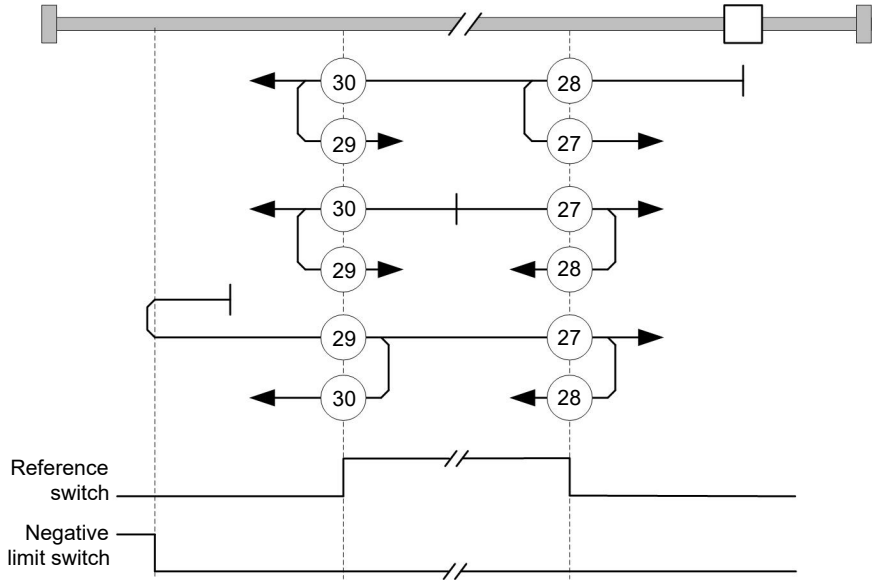
Reference to the home switch without the index pulse (with limit switches).

With these methods, the current position relative to the home switch is not important. With method 26, for example, referencing is always performed to the index pulse to the right of the right edge of the home switch.

Methods 23 to 26 take the positive home switch into account:



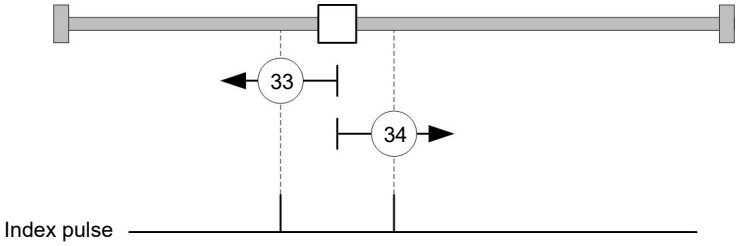
Methods 27 to 30 take the negative home switch into account:



10.7.2.10 Methods 33 and 34

Reference to the next index pulse.

With these methods referencing is only performed to the respective subsequent index pulse:



10.7.2.11 Method 37

References to the current position.

NOTICE

For homing mode 37, it is not necessary to switch the CiA 402 Power State Machine to the "Operation enabled" state. When energizing the motor windings in *open-loop* mode, it is thereby possible to prevent the current position from not being exactly 0 after Homing Mode 37.

10.8 Clock-direction mode

10.8.1 Description

In clock-direction mode, the motor is operated via two inputs by a higher-level positioning controller with clock and direction signal. On each clock signal, the motor moves one step in the direction corresponding to the direction signal.

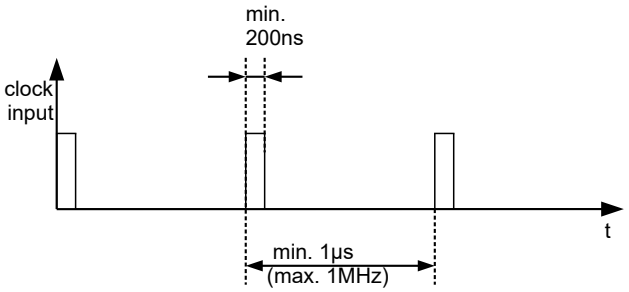
10.8.2 Activation

To activate the mode, the value "-1" (or "FF_h") must be set in object 6060_h (Modes Of Operation) (see "CiA 402 Power State Machine").

10.8.3 General

The following data apply for every subtype of the clock-direction mode:

- The maximum frequency of the input pulse is 1 MHz; the ON pulse should not be less than 200 ns.



- The demand position resulting from the input pulses is updated cyclically; the cycle time corresponds to the Interpolation Time Period ($60C2_h$). The input pulses that arrive within a cycle are collected and buffered in the controller.
- The steps are scaled using objects 2057_h and 2058_h. The following formula applies here:

$$\text{step width per pulse} = \frac{2057_h}{2058_h}$$

The "step size per pulse" value is set to 128 (2057_h=128 and 2058_h=1) ex works, which corresponds to a quarter step per pulse. A full step is the value "512", a half step per pulse corresponds to "256", etc.

NOTICE

For a stepper motor with 50 pole pairs, 200 full steps correspond to one mechanical revolution of the motor shaft.
In *clock-direction mode*, the BLDC motors are also handled as stepper motors by the controller. This means that for a BLDC motor with, e.g., 3 pole pairs, 12 (=4*3) full steps correspond to one revolution.

NOTICE

If there is a change of direction, a time of at least 35 µs must elapse before the new clock signal is applied.

10.8.4 Statusword

The following bits in object 6041_h (statusword) have a special function:

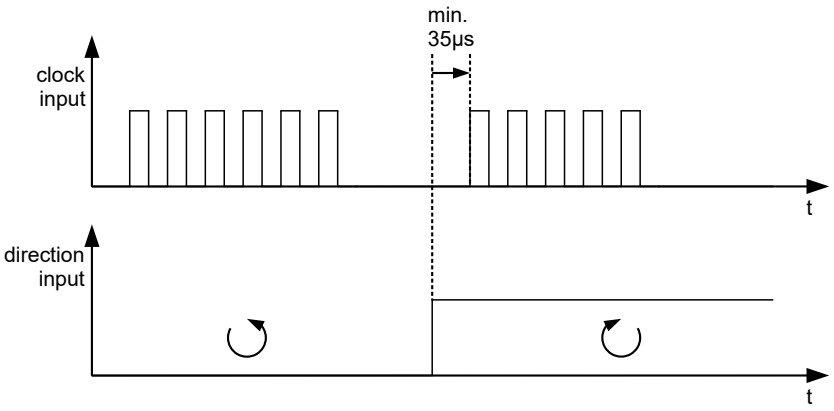
- Bit 13 (Following Error): This bit is set in *closed loop* mode if the following error is greater than the set limits (6065_h (Following Error Window) and 6066_h (Following Error Time Out)).

10.8.5 Subtypes of the clock-direction mode

10.8.5.1 Clock-direction mode (TR mode)

To activate the mode, object $205B_h$ must be set to the value "0" (factory settings).

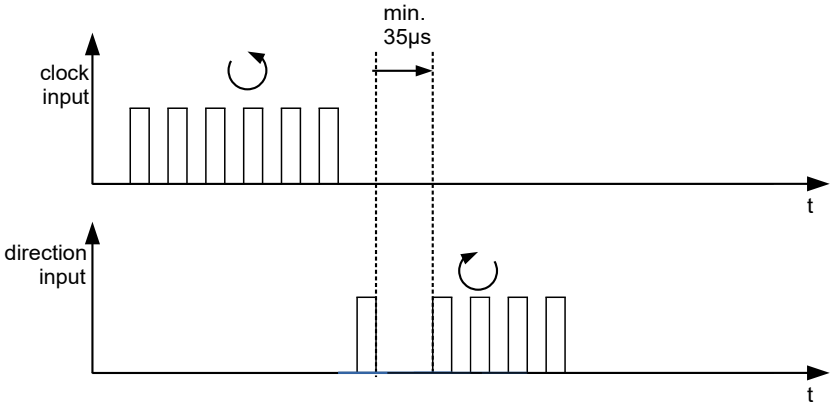
In this mode, the pulses must be preset via the clock input; the signal of the direction input specifies the direction of rotation here (see following graphic).



10.8.5.2 Right / left rotation mode (CW / CCW mode)

To activate the mode, object 205B$_h$ must be set to the value "1".

In this mode, the input that is used decides the direction of rotation (see following graphic).



NOTICE

To avoid any interference from influencing the clock signal, do not leave the currently unsued pin floating, connect it to GND.

10.9 Auto setup

10.9.1 Description

To determine a number of parameters related to the motor and the connected sensors (encoders/Hall sensors), an *auto setup* is performed. Closed-Loop operation requires a successfully completed *auto setup*. *Auto setup* is only to be performed once during commissioning as long as the motor/sensor connected to the controller is not changed. For details, see the corresponding section in chapter Commissioning.

10.9.2 Activation

To activate the mode, the value "-2" (="FE$_h$") must be set in object 6060$_h$ (Modes Of Operation) (see CiA 402 Power State Machine).

10.9.3 Controlword

The following bits in object 6040$_h$ (controlword) have a special function:

- Bit 4 starts a travel command. This is carried out on a transition from "0" to "1".

10.9.4 Statusword

The following bits in object 6041_h (statusword) have a special function:

- Bit 10: Indexed: indicates whether (= "1") or not (= "0") an encoder index was found.
- Bit 12: Aligned: this bit is set to "1" after *auto setup* has concluded

10.10 Limitation of the range of motion

The digital inputs can be used as limit switches, as is described in chapter Digital inputs, if you activate this function for the inputs. The controller also supports software limit switches.

10.10.1 Behavior upon reaching the limit switch

If a limit switch is triggered, the limit switch position is stored internally, bit 7 (*Warning*) in 6041_h (*statusword*) is set and the CiA 402 Power State Machine is set to status *Quick Stop Active*. The action stored in object 3701_h is thereby executed (see following table).

Value in object 3701_h	Description
-2	No reaction, discard the limit switch position
-1 (factory settings)	No reaction (e. g., to execute a homing operation) except noting the limit switch position
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely (*Switch on disabled* state)
1	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Switch on disabled*
2	Braking with *quick stop ramp* and subsequent state change to *Switch on disabled*
5	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Quick stop active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.
6	Braking with *quick stop ramp* and subsequent state change to *Quick Stop Active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.

Continued travel behind the limit switch position is prevented provided the value in 3701_h is not "-1" or "-2". In any case, it is possible to move in the opposite direction.

If the value "-2" is used, bit 7 in 6041_h (Warning) is deleted as soon as the limit switches no longer trigger. Otherwise, it is not deleted until the internally noted limit switch position has been returned to.

NOTICE

To avoid automatically returning from the *Quick stop active* state to *Operation enabled* when using options "5" or "6" — the quick-stop bit (bit 2) in 6040_h is not used upon triggering of the limit switches — a change of the quick-stop bit from "0" to "1" is expected in order to changed back to the *Operation enabled* state (605Ah Quick Stop Option Code must be set to "5" or "6").

Discarding the limit switch position

NOTICE

It is necessary to discard the limit switch positions if both limit switches were actuated simultaneously or the movement range is dynamically limited by a shifting of the limit switches.

To delete internally stored limit switch positions in the event of triggering and to release or clear the limit switches, briefly set object 3701_h to "-2".

If, when using the values "5" or "6" in 3701_h, the state of the *State Machine* is *Quick stop active* and the motor is to remain energized, proceed as follows to avoid an automatic change to the *Switch on disabled* state:

1. Use a rising edge of bit 2 (quick stop) in 6040_h to switch back to the *Operation enabled* state without, however, starting a movement (set bit 4 in 6040_h to 0 or target speed or target torque to "0").
2. Set 3701_h to "-2" .
3. Release the limit switch again.
4. Reset 3701_h back to "5" or "6".

10.10.2 Software limit switches

The controller takes into account software limit switches ($607D_h$ (Software Position Limit)). Target positions ($607A_h$) are limited by $607D_h$; the absolute target position may not be larger than the limits in $607D_h$. If the motor is located outside of the permissible range when setting up the limit switches, only travel commands in the direction of the permissible range are accepted.

11 Description of the *CiA 402* object dictionary

11.1 Overview

This chapter contains a description of all objects.

You will find information here on:

- Functions
- Object descriptions ("Index")
- Value descriptions ("Subindices")
- Descriptions of bits
- Description of the object

11.2 Structure of the object description

The description of the object entries always has the same structure and usually consists of the following sections:

Function

The function of the object dictionary is briefly described in this section.

Object description

This table provides detailed information on the data type, preset values and similar. An exact description can be found in section "Object description"

Value description

This table is only available with the "Array" or "Record" data type and provides exact information about the sub-entries. A more exact description of the entries can be found in section "Value description"

Description

Here, more exact information on the individual bits of an entry is provided or any compositions explained. A more exact description can be found in section "Description"

11.3 Object description

The object description consists of a table that contains the following entries:

Index

Designates the object index in hexadecimal notation.

Object name

The name of the object.

Object Code

The type of object. This can be one of the following entries:

- VARIABLE: In this case, the object consists of only a variable that is indexed with subindex 0.
- ARRAY: These objects always consists of a subindex 0 – which specifies the number of sub-entries – and the sub-entries themselves, beginning with index 1. The data type within an array never changes, i.e., sub-entry 1 and all subsequent entries are always of the same data type.
- RECORD: These objects always consists of a subindex 0 – which specifies the number of sub-entries – and the sub-entries themselves, beginning with index 1. Unlike an ARRAY, the data type of the sub-entries can vary. This means that, e.g., sub-entry 1 may be of a different data type than sub-entry 2.

- VISIBLE_STRING: The object describes a character string coded in ASCII. The length of the string is specified in subindex 0; the individual characters are stored beginning in subindex 1. These character strings are **not** terminated by a null character.

Data type

The size and interpretation of the object is specified here. The following notation is used for the "VARIABLE" object code:

- A distinction is made between entries that are signed; these are designated with the prefix "SIGNED". For entries that are unsigned, the prefix "UNSIGNED" is used.
- The size of the variable in bits is placed before the prefix and can be 8, 16 or 32.

Savable

Described here is whether this object is savable and, if so, in which category.

Firmware version

The firmware version beginning with which the object is available is entered here.

Change history (ChangeLog)

Any changes to the object are noted here.

There are also the following table entries for the "VARIABLE" data type:

Access

The access restriction is entered here. The following restrictions are available:

- "read/write": The object can both be read as well as written
- "read only": The object can only be read from the object dictionary. It is not possible to set a value.

PDO mapping

Some bus systems, such as CANopen or EtherCAT, support PDO mapping. Described in this table entry is whether the object can be inserted into a mapping and, if so, into which. The following designations are available here:

- "no": The object may not be entered in a mapping.
- "TX-PDO": The object may be entered in an RX mapping.
- "RX-PDO": The object may be entered in a TX mapping.

Allowed values

In some cases, only certain values may be written in the object. If this is the case, these values are listed here. If there are no restrictions, the field is empty.

Preset value

To bring the controller to a secured state when switching on, it is necessary to preset a number of objects with values. The value that is written in the object when the controller is started is noted in this table entry.

11.4 Value description

NOTICE

For the sake of clarity, a number of subindices are grouped together if the entries all have the same name.

Listed in the table with the "Value description" heading are all data for sub-entries with subindex 1 or higher. The table contains the following entries:

Subindex

Number of the currently written sub-entry.

Name

Name of the sub-entry.

Data type

The size and interpretation of the sub-entry is specified here. The following notation always applies here:

- A distinction is made between entries that are signed; these are designated with the prefix "SIGNED". For entries that are unsigned, the prefix "UNSIGNED" is used.
- The size of the variable in bits is placed before the prefix and can be 8, 16 or 32.

Access

The access restriction for the sub-entry is entered here. The following restrictions are available:

- "read/write": The object can both be read as well as written
- "read only": The object can only be read from the object dictionary. It is not possible to set a value.

PDO mapping

Some bus systems, such as CANopen or EtherCAT, support PDO mapping. Described in this table entry is whether the sub-entry can be inserted into a mapping and, if so, into which. The following designations are available here:

- "no": The object may not be entered in a mapping.
- "TX-PDO": The object may be entered in an RX mapping.
- "RX-PDO": The object may be entered in a TX mapping.

Allowed values

In some cases, only certain values may be written in the sub-entry. If this is the case, these values are listed here. If there are no restrictions, the field is empty.

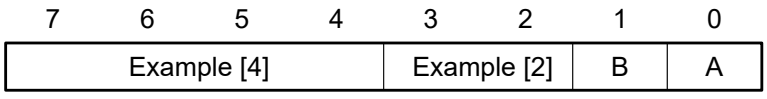
Preset value

To bring the controller to a secured state when switching on, it is necessary to preset a number of sub-entries with values. The value that is written in the sub-entry when the controller is started is noted in this table entry.

11.5 Description

This section may be present if use requires additional information. If individual bits of an object or sub-entry have different meaning, diagrams as shown in the following example are used.

Example: The object is 8 bits in size; bit 0 and bit 1 have different functions. Bits 2 and 3 are grouped into one function; the same applies for bits 4 to 7.



Example [4]

Description of bit 4 up to and including bit 7; these bits are logically related. The 4 in square brackets specifies the number of related bits. A list with possible values and their description is often attached at this point.

Example [2]

Description of bits 3 and 2; these bits are logically related. The 2 in square brackets specifies the number of related bits.

- Value 00_b: The description here applies if bit 2 and bit 3 are "0".
- Value 01_b: The description here applies if bit 2 is "0" and bit 3 is "1".
- Value 10_b: The description here applies if bit 2 is "1" and bit 3 is "0".
- Value 11_b: The description here applies if bit 2 and bit 3 are "1".

B

Description of bit B; no length is specified for a single bit.

A

Description of bit A; bits with a gray background are not used.

1000h Device Type

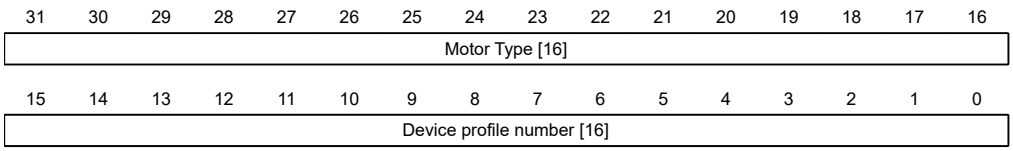
Function

Describes the controller type.

Object description

Index	1000_h
Object name	Device Type
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	00060192_h
Firmware version	FIR-v1426
Change history	

Description



Motor Type[16]

Describes the supported motor type. The following values are possible:

- Bit 23 to bit 16: Value "2": BLDC motor
- Bit 23 to bit 16: Value "4": Stepper motor
- Bit 23 to bit 16: Value "6": Stepper motor as well as BLDC motor

Device profile number[16]

Describes the supported CANopen standard.

Values:

0192_h or 0402_d (preset value): The CiA 402 standard is supported.

1001h Error Register

Function

Error register: In the event of an error, the corresponding error bit(s) is/are set. If the error no longer exists, it is deleted automatically.

NOTICE

For each error that occurs, a more precise error code is stored in object 1003_h.

Object description

Index	1001_h
Object name	Error Register
Object Code	VARIABLE
Data type	UNSIGNED8
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h
Firmware version	FIR-v1426
Change history	

Description

7	6	5	4	3	2	1	0
MAN	RES	PROF	COM	TEMP	VOL	CUR	GEN

GEN

General error, always set in the event of an error

CUR

Current

VOL

Voltage

TEMP

Temperature

COM

Communication

PROF

Relates to the device profile

RES

Reserved, always "0"

MAN

Manufacturer-specific

1003h Pre-defined Error Field

Function

This object contains an error stack with up to eight entries.

Object description

Index	1003_h
Object name	Pre-defined Error Field
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Errors
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00_h

Subindex	01_h
Name	1st Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	2nd Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	

Preset value	00000000_h

Subindex	03_h
Name	3th Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	4th Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	5th Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	6th Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	07_h
Name	7th Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h

Name	8th Standard Error Field
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

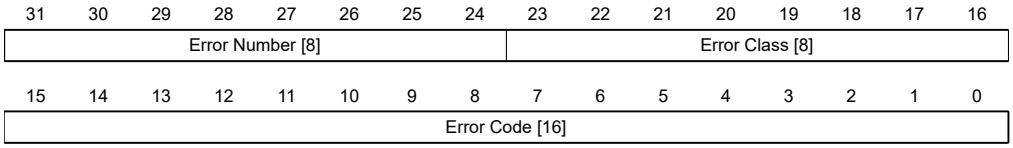
Description

General function

If a new error occurs, it is entered in subindex 1. The already existing entries in subindices 1 to 7 are moved back one position. The error in subindex 7 is thereby removed.

The number of errors that have already occurred can be read from the object with subindex 0. If no error is currently entered in the error stack, it is not possible to read one of the eight subindices 1–8 and an error (abort code = 08000024_h) is sent in response. If a "0" is written in subindex 0, counting starts again from the beginning.

Bit description



Error Number [8]

This can be used to pinpoint the cause of the error. The meaning of the number can be found in the following table.

Error number	Description
0	Watchdog-Reset
1	Input voltage (+Ub) too high
2	Output current too high
3	Input voltage (+Ub) too low
4	Error at fieldbus
6	CANopen only: NMT master takes too long to send Nodeguarding request
7	Sensor 1 (see 3204_h): Error through electrical fault or defective hardware
8	Sensor 2 (see 3204_h): Error through electrical fault or defective hardware
9	Sensor 3 (see 3204_h): Error through electrical fault or defective hardware
10	Warning: Positive limit switch exceeded
11	Warning: Negative limit switch exceeded
12	Overtemperature error
13	The values of object 6065_h (Following Error Window) and object 6066_h (Following Error Time Out) were exceeded; a fault was triggered.
14	Warning: Nonvolatile memory full. The current save process could not be completed; parts of the data of the save process are lost. Controller must be restarted for cleanup work.
15	Motor blocked
16	Warning: Nonvolatile memory damaged; controller must be restarted for cleanup work (all saved objects are reset to default).
17	CANopen only: Slave took too long to send PDO messages.

Error number	Description
18	Sensor n (see 3204_h), where n is greater than 3: Error through electrical fault or defective hardware
19	CANopen only: PDO not processed due to a length error
20	CANopen only: PDO length exceeded
21	Warning: Restart the controller to avoid future errors when saving (nonvolatile memory full/corrupt).
22	Rated current must be set (6075_h)
23	Encoder resolution, number of pole pairs and some other values are incorrect.
24	Motor current is too high, adjust the PI parameters.
25	Internal software error, generic
26	Current too high at digital output
27	CANopen only: Unexpected sync length
30	Error in speed monitoring: slippage error too large
32	Internal error: Correction factor for reference voltage missing in the OTP
35	*STO Fault*: STO was requested but not via both STO inputs.
36	*STO Changeover*: STO was requested but not via both STO inputs. If this state lasts longer than 100 ms, the controller switches to the *STO Fault* state.
37	*STO Active*: STO is active, it generates no torque or holding torque.
38	*STO Self-Test*: Error during self-test of the firmware. Contact Nanotec.
39	Error in the ballast configuration: Invalid/unrealistic parameters entered (see Ballast monitoring)
40	Warning: Ballast resistor thermally overloaded
41	Only EtherCAT: *Sync Manager Watchdog*: The controller has not received any PDO data for an excessively long period of time; check the software and hardware connections.
43	Input voltage (+Ub Logic) too high
44	Input voltage (+Ub Logic) too low
46	Interlock error: Bit 3 in $60FD_h$ is set to "0", the motor may not start (see the section *Interlock function* in the chapter Digital inputs)
48	Only CANopen: NMT status has been set to *stopped*
52	Fieldbus cycle time exceeded.
53	PROFINET only: wrong stack version

Error Class[8]

This byte is identical to object 1001_h

Error Code[16]

Refer to the following table for the meaning of the bytes.

Error Code	Description
1000_h	General error
2300_h	Current at the controller output too large
3100_h	Overvoltage/undervoltage at controller input
4200_h	Temperature error within the controller

Error Code	Description
5440_h	Interlock error: Bit 3 in $60FD_h$ is set to "0", the motor may not start (see the section *Interlock function* in the chapter Digital inputs)
6010_h	Software reset (watchdog)
6100_h	Internal software error, generic
6320_h	Rated current must be set (6075_h)
7110_h	Error in the ballast configuration: Invalid/unrealistic parameters entered (see Ballast monitoring)
7113_h	Warning: Ballast resistor thermally overloaded
7121_h	Motor blocked
7200_h	Internal error: Correction factor for reference voltage missing in the OTP
7305_h	Sensor 1 (see 3204_h) faulty
7306_h	Sensor 2 (see 3204_h) faulty
7307_h	Sensor n (see 3204_h), where n is greater than 2
7600_h	Warning: Nonvolatile memory full or corrupt; restart the controller for cleanup work
8000_h	general error during monitoring of the STO function
8001_h	general error during monitoring of the STO function
8002_h	general error during monitoring of the STO function
8003_h	*STO Self-Test*: Error during self-test of the firmware. Contact Nanotec.
8100_h	Error during fieldbus monitoring
8130_h	CANopen only: "Life Guard" error or "Heartbeat" error
8200_h	CANopen only: Slave took too long to send PDO messages.
8210_h	CANopen only: PDO was not processed due to a length error
8220_h	CANopen only: PDO length exceeded
8240_h	CANopen only: unexpected sync length
8400_h	Error in speed monitoring: slippage error too large
8611_h	Position monitoring error: Following error too large
8612_h	Position monitoring error: Limit switch exceeded

1008h Manufacturer Device Name

Function

Contains the device name as character string.

Object description

Index	1008_h
Object name	Manufacturer Device Name
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	

Preset value	■ N6-1-10-1-S: N6-1-10-1-S ■ N6-1-10-1: N6-1-10-1 ■ N6-2-10-1-S: N6-2-10-1-S ■ N6-2-10-1: N6-2-10-1
Firmware version	FIR-v1426
Change history	

1009h Manufacturer Hardware Version

Function

This object contains the hardware version as character string.

Object description

Index	1009_h
Object name	Manufacturer Hardware Version
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v1426
Change history	

100Ah Manufacturer Software Version

Function

This object contains the software version as character string.

Object description

Index	$100A_h$
Object name	Manufacturer Software Version
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	FIR-v2529-B1076225
Firmware version	FIR-v1426
Change history	

1010h Store Parameters

Function

This object is used to start the saving of objects. See chapter Saving objects.

Object description

Index	1010_h
Object name	Store Parameters
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1436: "Object name" entry changed from "Store Parameter" to "Store Parameters". Firmware version FIR-v1436: The number of entries was changed from 3 to 4. Firmware version FIR-v1512: The number of entries was changed from 4 to 5. Firmware version FIR-v1540: The number of entries was changed from 5 to 7. Firmware version FIR-v1738-B501312: The number of entries was changed from 7 to 14. Firmware version FIR-v2412-B1057638: "Name" entry changed from "Save Miscellaneous Configurations To Non-volatile Memory" to "Save Reserved0 Configurations To Non-volatile Memory". Firmware version FIR-v2451-B1068465: "Name" entry changed from "Save Drive Parameters To Non-volatile Memory" to "Save Motor Parameters To Non-volatile Memory". Firmware version FIR-v2451-B1068465: "Name" entry changed from "Save Tuning Parameters To Non-volatile Memory" to "Save Sensor Parameters To Non-volatile Memory".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	$0C_h$

Subindex	01_h
Name	Save All Parameters To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	02_h
Name	Save Communication Parameters To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	03_h
Name	Save Application Parameters To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	04_h
Name	Save Customer Parameters To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	05_h
Name	Save Motor Parameters To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	06_h
Name	Save Sensor Parameters To Non-volatile Memory
Data type	UNSIGNED32

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	07_h
Name	Save Reserved0 Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	Save Reserved1 Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	09_h
Name	Save Reserved2 Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0A_h$
Name	Save CANopen Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	$0B_h$
Name	Save Modbus RTU Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	

Preset value	00000001_h

Subindex	$0C_h$
Name	Save Ethernet Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Description

Each subindex of the object stands for a certain memory class. By reading out the entry, it is possible to determine whether (value "1") or not (value="0") this memory category can be saved.

To start the save process of a memory category, value "65766173_h" must be written in the corresponding subindex. This corresponds to the decimal of 1702257011_d or the ASCII string `save`. As soon as the saving process is completed, the save command is again overwritten with the value "1", since saving is possible again.

For a detailed description, see chapter Saving objects.

1011h Restore Default Parameters

Function

This object can be used to reset all or part of the object dictionary to the default values. See chapter Saving objects.

Object description

Index	1011_h
Object name	Restore Default Parameters
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "Restore Default Parameter" to "Restore Default Parameters". Firmware version FIR-v1436: The number of entries was changed from 2 to 4. Firmware version FIR-v1512: The number of entries was changed from 4 to 5. Firmware version FIR-v1512: "Name" entry changed from "Restore The Comm Default Parameters" to "Restore Communication Default Parameters".

	Firmware version FIR-v1512: "Name" entry changed from "Restore The Application Default Parameters" to "Restore Application Default Parameters". Firmware version FIR-v1540: The number of entries was changed from 5 to 7. Firmware version FIR-v1738-B501312: The number of entries was changed from 7 to 14. Firmware version FIR-v2412-B1057638: "Name" entry changed from "Restore Miscellaneous Configurations" to "Restore Reserved0 Configurations To Non-volatile Memory". Firmware version FIR-v2451-B1068465: "Name" entry changed from "Restore Drive Default Parameters" to "Restore Motor Default Parameters". Firmware version FIR-v2451-B1068465: "Name" entry changed from "Restore Tuning Default Parameters" to "Restore Sensor Default Parameters".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	$0C_h$

Subindex	01_h
Name	Restore All Default Parameters
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	02_h
Name	Restore Communication Default Parameters
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	03_h
Name	Restore Application Default Parameters

Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	04_h
Name	Restore Customer Default Parameters
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	05_h
Name	Restore Motor Default Parameters
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	06_h
Name	Restore Sensor Default Parameters
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	07_h
Name	Restore Reserved0 Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	Restore Reserved1 Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no

Allowed values	
Preset value	00000000_h

Subindex	09_h
Name	Restore Reserved2 Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0A_h$
Name	Restore CANopen Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	$0B_h$
Name	Restore Modbus RTU Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	$0C_h$
Name	Restore Ethernet Configurations To Non-volatile Memory
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Description

If the value $64616F6C_h$ (or 1684107116_d or ASCII `load`) is written in this object, part or all of the object dictionary is reset to the default values. The subindex that is used decides which range is reset.

For a detailed description, see chapter Discarding the saved data.

1018h Identity Object

Function

This object returns general information on the device, such as manufacturer, product code, revision and serial number.

TIP

Have these values ready in the event of service inquiries.

Object description

Index	1018_h
Object name	Identity Object
Object Code	RECORD
Data type	IDENTITY
Savable	no
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Vendor ID
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	$0000026C_h$

Subindex	02_h
Name	Product Code
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	■ N6-1-10-1-S: $0011000A_h$

- N6-1-10-1: 0011010A$_h$
- N6-2-10-1-S: 0012000A$_h$
- N6-2-10-1: 0012010A$_h$

Subindex	03$_h$
Name	Revision Number
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	09E10000$_h$

Subindex	04$_h$
Name	Serial Number
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000$_h$

1020h Verify Configuration

Function

This object indicates the date and time that the configuration was stored.

A configuration tool or a master can use this object to verify the configuration after a reset and, if necessary, perform a new configuration.

The tool must set the date and time before the storage mechanism is started (see chapter Saving objects).

Object description

Index	1020$_h$
Object name	Verify Configuration
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: verify
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Configuration Date
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Configuration Time
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

Subindex 01_h (configuration date) is to contain the number of days since 1 January 1984.

Subindex 02_h (configuration time) is to contain the number of milliseconds since midnight.

1F50h Program Data

Function

This object is used to program memory areas of the controller. Each entry stands for a certain memory area.

Object description

Index	$1F50_h$
Object name	Program Data
Object Code	ARRAY
Data type	DOMAIN
Savable	no
Access	read only
PDO mapping	no
Allowed values	

Preset value	
Firmware version	FIR-v1540
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Program Data Bootloader/firmware
Data type	DOMAIN
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0

Subindex	02_h
Name	Program Data NanoJ
Data type	DOMAIN
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0

1F51h Program Control

Function

This object is used to control the programming of memory areas of the controller. Each entry stands for a certain memory area.

Object description

Index	$1F51_h$
Object name	Program Control
Object Code	ARRAY
Data type	UNSIGNED8
Savable	no
Access	read only
PDO mapping	no

Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Program Control Bootloader/firmware
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00_h

Subindex	02_h
Name	Program Control NanoJ
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00_h

1F57h Program Status

Function

This object indicates the programming status during the programming of memory areas of the controller. Each entry stands for a certain memory area.

Object description

Index	$1F57_h$
Object name	Program Status
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only

PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Program Status Bootloader/firmware
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Program Status NanoJ
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

200Fh IEEE 802 MAC Address

Function

This object contains the MAC address of the controller as a character string.

Object description

Index	$200F_h$
Object name	IEEE 802 MAC Address
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no

Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v1748-B533384
Change history	

2010h IP-Configuration

Function

Use this object to configure the Ethernet interface. The object is only taken into consideration once when restarting the controller. You can find further details in chapter *Commissioning*.

Object description

Index	2010_h
Object name	IP-Configuration
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1748-B533384: "Savable" entry changed from "yes, category: communication" to "yes, category: Ethernet".

Description

IP

Value = "1": A static IP address from object 2011_h is used and the network mask from object 2012_h is used.

DHCP

Value = "1": IP address assignment using a DHCP server is activated

AUTO

Value = "1": IP address assignment using the AUTO-IP protocol is activated

NBIOS

Value = "1": The NetBIOS protocol is activated; this is necessary before resolving a hostname (e.g., with a ping command).

LLMNR

Value = "1": The LLMNR protocol is activated; this is necessary before resolving a hostname (e.g., with a ping command).

NOTICE

To avoid conflicts, never simultaneously set bit 0 (static IP address) and bits 2 and 3 (DHCP or Auto-IP) to "1".

2011h Static-IPv4-Address

Function

Contains the static IPv4 address in the form of a 32-bit word.

Object description

Index	2011_h
Object name	Static-IPv4-Address
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$C0A80792_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1450: "Object Name" entry changed from "Static-IP-Address" to "Static-IPv4-Address". Firmware version FIR-v1748-B533384: "Savable" entry changed from "yes, category: communication" to "yes, category: Ethernet".

Description

IP Address Part 1 [8]

Specifies the first part of the IP address

IP Address Part 2 [8]

Specifies the second part of the IP address

IP Address Part 3 [8]

Specifies the third part of the IP address

IP Address Part 4 [8]

Specifies the fourth part of the IP address

Example

Address `192.168.2.0` is first converted to hexadecimal format, resulting in the following configuration value:

192 => $C0_h$

168 => $A8_h$

2 => 02_h

0 => 0

The corresponding adjustment value is then $C0A80200_h$.

2012h Static-IPv4-Subnet-Mask

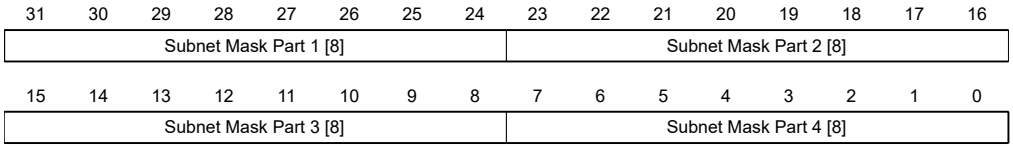
Function

Contains the subnet mask of the static IP address in the form of a 32-bit word.

Object description

Index	2012_h
Object name	Static-IPv4-Subnet-Mask
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$FFFFFF00_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1450: "Object Name" entry changed from "Static-IP-Subnet-Mask" to "Static-IPv4-Subnet-Mask". Firmware version FIR-v1748-B533384: "Savable" entry changed from "yes, category: communication" to "yes, category: Ethernet".

Description



Subnet Mask Part 1 [8]

Specifies the first part of the subnet mask

Subnet Mask Part 2 [8]

Specifies the second part of the subnet mask

Subnet Mask Part 3 [8]

Specifies the third part of the subnet mask

Subnet Mask Part 4 [8]

Specifies the fourth part of the subnet mask

Example

The class C network mask `255.255.255.0` is first converted to hexadecimal format, resulting in the following configuration value:

255 => FF_h

0 => 0

The corresponding adjustment value is then $FFFFFF00_h$.

2013h Static-IPv4-Gateway-Address

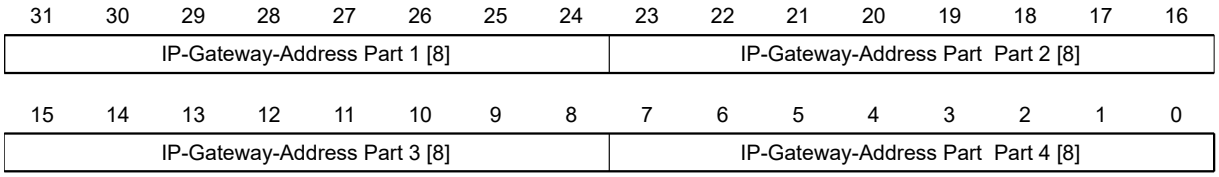
Function

Contains the static IP gateway address in the form of a 32-bit word.

Object description

Index	2013_h
Object name	Static-IPv4-Gateway-Address
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: Ethernet
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1446
Change history	Firmware version FIR-v1512: "Object Name" entry changed from "Static-IP-Gateway-Address" to "Static-IPv4-Gateway-Address". Firmware version FIR-v1748-B533384: "Savable" entry changed from "yes, category: communication" to "yes, category: Ethernet".

Description



IP-Gateway-Address Part 1 [8]

Specifies the first part of the IP gateway address

IP-Gateway-Address Part 2 [8]

Specifies the second part of the IP gateway address

IP-Gateway-Address Part 3 [8]

Specifies the third part of the IP gateway address

IP-Gateway-Address Part 4 [8]

Specifies the fourth part of the IP gateway address

Example

Address `192.168.2.0` is first converted to hexadecimal format, resulting in the following configuration value:

192 => $C0_h$

168 => $A8_h$

2 => 02_h

0 => 0

The corresponding adjustment value is then $C0A80200_h$.

2014h Current-IPv4-Address

Function

Contains the currently active IP address in the form of a 32-bit word.

Object description

Index	2014_h
Object name	Current-IPv4-Address
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1450: "Object Name" entry changed from "Current-IP-Address" to "Current-IPv4-Address".

Description

IP Address Part 1 [8]

Specifies the first part of the IP address

IP Address Part 2 [8]

Specifies the second part of the IP address

IP Address Part 3 [8]

Specifies the third part of the IP address

IP Address Part 4 [8]

Specifies the fourth part of the IP address

Example

Address `192.168.2.0` is first converted to hexadecimal format, resulting in the following configuration value:

192 => $C0_h$

168 => $A8_h$

2 => 02_h

0 => 0

The corresponding adjustment value is then $C0A80200_h$.

2015h Current-IPv4-Subnet-Mask

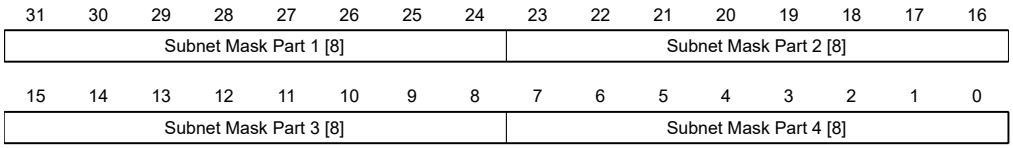
Function

Contains the currently active subnet mask of the static IP address in the form of a 32-bit word.

Object description

Index	2015_h
Object name	Current-IPv4-Subnet-Mask
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1450: "Object Name" entry changed from "Current-IP-Subnet-Mask" to "Current-IPv4-Subnet-Mask".

Description



Subnet Mask Part 1 [8]
Specifies the first part of the subnet mask

Subnet Mask Part 2 [8]
Specifies the second part of the subnet mask

Subnet Mask Part 3 [8]
Specifies the third part of the subnet mask

Subnet Mask Part 4 [8]
Specifies the fourth part of the subnet mask

Example

The class C network mask `255.255.255.0` is first converted to hexadecimal format, resulting in the following configuration value:

255 => FF_h

0 => 0

The corresponding adjustment value is then $FFFFFF00_h$.

2016h Current-IPv4-Gateway-Address

Function

This object contains the currently active gateway IP address in the form of a 32-bit word.

Object description

Index	2016_h
Object name	Current-IPv4-Gateway-Address
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1540
Change history	

2030h Pole Pair Count

Function

Contains the number of pole pairs of the connected motor.

Object description

Index	2030_h

Object name	Pole Pair Count
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: motor
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0032_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1540: "Savable" entry changed from "no" to "yes, category: tuning". Firmware version FIR-v2315-B1040535: "Data type" entry changed from "UNSIGNED32" to "UNSIGNED16".

2034h Upper Voltage Warning Level

Function

This object contains the threshold value for the "overvoltage" error in millivolts.

Object description

Index	2034_h
Object name	Upper Voltage Warning Level
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$0000EA60_h$
Firmware version	FIR-v1426
Change history	

Description

If the input voltage of the controller exceeds this threshold value, the motor is switched off and an error triggered. As soon as the input voltage is again smaller than the voltage of object 2034_h minus 2 volt, you can reset the error via the controlword.

2035h Lower Voltage Warning Level

Function

This object contains the threshold value for the "Undervoltage" error in millivolts.

Object description

Index	2035_h

Object name	Lower Voltage Warning Level
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00002710_h
Firmware version	FIR-v1426
Change history	

Description

If the input voltage of the controller falls below this threshold value, the motor is switched off and an error triggered. As soon as the input voltage is again larger than the voltage of object 2035_h plus 1.5 volt, you can reset the error via the controlword.

2038h Brake Controller Timing

Function

This object contains the times for the *brake control* in milliseconds as well as the PWM frequency and the duty cycle.

Object description

Index	2038_h
Object name	Brake Controller Timing
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	06_h

Subindex	01_h
Name	Close Brake Idle Time
Data type	UNSIGNED32
Access	read / write

PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Subindex	02_h
Name	Shutdown Power Idle Time
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Subindex	03_h
Name	Open Brake Delay Time
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Subindex	04_h
Name	Start Operation Delay Time
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	PWM Frequency
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	between 50 and 20000 ($4E20_h$)
Preset value	$00004E20_h$

Subindex	06_h
Name	PWM Duty Cycle
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	Between 0 and 100 (64_h)
Preset value	00000032_h

Description

The subindices have the following functions:

- 01_h: Time between motor standstill and the closing of the brake.
- 02_h: Time between the closing of the brake and the switching off of the motor current.
- 03_h: Time between the switching on of the motor current and opening of the brake.
- 04_h: Time between the opening of the brake and when the *Operation enabled* state of the CiA 402 Power State Machine is reached.
- 05_h: Frequency of the PWM signal in hertz.
- 06_h: Duty cycle of the PWM signal in percent. Value "0" switches off the PWM signal.

2039h Motor Currents

Function

This object contains the measured motor currents in mA. All values are peak values, (#2*rms).

Object description

Index	2039_h
Object name	Motor Currents
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1504: "PDO mapping" table entry for subindex 01 changed from "no" to "TX-PDO". Firmware version FIR-v1504: "PDO mapping" table entry for subindex 02 changed from "no" to "TX-PDO". Firmware version FIR-v1504: "PDO mapping" table entry for subindex 03 changed from "no" to "TX-PDO". Firmware version FIR-v1504: "PDO mapping" table entry for subindex 04 changed from "no" to "TX-PDO". Firmware version FIR-v2213: subindex 05_h, "Actual Current" added. Phase currents Ia and Ib changed to Iα and Iβ (Clarke transformation).

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	05_h

Subindex	01_h
Name	Id
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Iq
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Iα
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	Iβ
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	Actual Current
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Description

- 01_h: Field-forming components of the current
- 02_h: Torque-forming components of the current

- 03_h: Iα
- 04_h: Iβ
- 05_h: total current calculated down to a motor phase. In *closed-loop*, the sign of Iq is also used. The current value can then be placed on a scale to compare with the current from 6075_h.
  Open-Loop:
  - Stepper motor: $I = \sqrt{(I\alpha^2 + I\beta^2)} / \sqrt{2}$
  - BLDC motor: $I = \sqrt{(I\alpha^2 + I\beta^2)} / (2/\sqrt{3})$

  Closed-Loop:
  - Stepper motor: $I = sgn(Iq) * \sqrt{(I\alpha^2 + I\beta^2)} / \sqrt{2}$
  - BLDC motor: $I = sgn(Iq) * \sqrt{(I\alpha^2 + I\beta^2)} / (2/\sqrt{3})$

203Dh Torque Window

Function

Specifies a symmetrical range relative to the target torque within which the target is considered having been met.

If the value is set to "FFFFFFFF"$_h$, monitoring is switched off, the "Target reached" bit in object 6041_h (statusword) is never set.

Object description

Index	$203D_h$
Object name	Torque Window
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1540
Change history	Firmware version FIR-v1614: "Savable" entry changed from "no" to "yes, category: application".

203Eh Torque Window Time Out

Function

The current torque must be within the "Torque Window" ($203D_h$) for this time (in milliseconds) for the target torque to be considered having been met.

Object description

Index	$203E_h$
Object name	Torque Window Time Out
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application

Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1540
Change history	Firmware version FIR-v1614: "Savable" entry changed from "no" to "yes, category: application". Firmware version FIR-v1738-B501312: "Object Name" entry changed from "Torque Window Time" to "Torque Window Time Out".

203Fh Max Slippage Time Out

Function

Time in milliseconds until an excessively large slippage error in Profile Velocity mode results in an error message.

Object description

Index	$203F_h$
Object name	Max Slippage Time Out
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0064_h
Firmware version	FIR-v1738-B501312
Change history	

Description

If the actual speed deviates so much from the set speed that the value (absolute value) of the object $60F8_h$ (Max Slippage) is exceeded, bit 13 in object 6041_h is set. The deviation must last longer than the time in object $203F_h$.

A reaction to the slippage error can be set in object 3700_h. If a reaction is defined, an error is also entered in object 1003_h.

2057h Clock Direction Multiplier

Function

The clock count value in Clock-direction mode is multiplied by this value before it is processed further.

Object description

Index	2057_h
Object name	Clock Direction Multiplier

Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000080_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v2339-B1048823: "Data type" entry changed from "INTEGER32" to "UNSIGNED32".

2058h Clock Direction Divider

Function

The clock count value in Clock-direction mode is divided by this value before it is processed further.

Object description

Index	2058_h
Object name	Clock Direction Divider
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v2339-B1048823: "Data type" entry changed from "INTEGER32" to "UNSIGNED32".

205Bh Clock Direction Or Clockwise/Counter-Clockwise Mode

Function

This object can be used to switch the clock-direction mode (value = "0") to the right/left rotation mode (value = "1").

Object description

Index	$205B_h$
Object name	Clock Direction Or Clockwise/Counter-Clockwise Mode
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no

Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1504
Change history	

205Ch Pulse Generator Configuration

Function

Use this object to configure the virtual encoder output. You can find details in chapter Digital inputs and outputs, pulse generator.

Object description

Index	$205C_h$
Object name	Pulse Generator Configuration
Object Code	ARRAY
Data type	INTEGER16
Savable	yes, category: application
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v2115-B1016293
Change history	Firmware version FIR-v2115-B1016293: "Name" entry changed from "Number Of Increments To Be Sent When No Sensor In 0x3203 Is Choosen" to "Number Of Increments To Be Sent When No Sensor In 0x3203 Is Choosen". Firmware version FIR-v2115-B1016293: "Name" entry changed from "Output Signal Mode: 0=AB, 1=ClkDir, 2=CW/CCW" to "Output Signal Mode: 0=AB, 1=ClkDir, 2=CW/CCW". Firmware version FIR-v2115-B1016293: "Name" entry changed from "Numerator For Conversion Of Sensor Increments To Virtual Encoder Increments" to "Numerator For Conversion Of Sensor Increments To Virtual Encoder Increments". Firmware version FIR-v2115-B1016293: "Name" entry changed from "Denominator For Conversion Of Sensor Increments To Virtual Encoder Increments" to "Denominator For Conversion Of Sensor Increments To Virtual Encoder Increments". Firmware version FIR-v2412-B1057638: "Object Name" entry changed from "Virtual Encoder Configuration" to "Pulse Generator Configuration". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Numerator For Conversion Of Sensor Increments To Virtual Encoder Increments" to "Numerator For Conversion Of Sensor Increments To Pulse Generator Increments". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Denominator For Conversion Of Sensor Increments To Virtual Encoder Increments" to "Denominator For Conversion Of Sensor Increments To Pulse Generator Increments".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Number Of Increments To Be Sent When No Sensor In 0x3203 Is Choosen
Data type	INTEGER16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Output Signal Mode: 0=AB, 1=ClkDir, 2=CW/CCW
Data type	INTEGER16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Numerator For Conversion Of Sensor Increments To Pulse Generator Increments
Data type	INTEGER16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Denominator For Conversion Of Sensor Increments To Pulse Generator Increments
Data type	INTEGER16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0001_h

2101h Fieldbus Module Availability

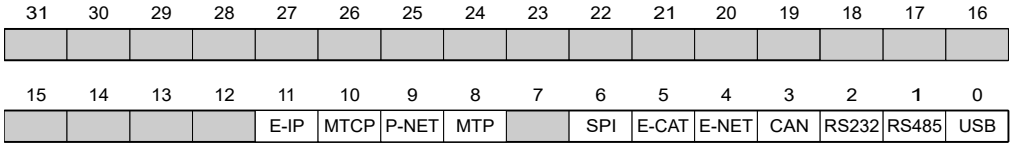
Function

Displays the available interfaces/fieldbuses or protocols.

Object description

Index	2101_h
Object name	Fieldbus Module Availability
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Object Name" entry changed from "Fieldbus Module" to "Fieldbus Module Availability". Firmware version FIR-v1529: new bit assignment

Description



USB

Value = "1": The USB fieldbus (Modbus RTU) is available.

RS-485

Value = "1": An RS-485 interface (Modbus RTU) is available.

RS-232

Value = "1": An RS-232 interface (Modbus RTU) is available.

CAN

Value = "1": The CANopen fieldbus is available.

E-NET

Value = "1": An Ethernet interface (REST protocol) is available.

E-CAT

Value = "1": An EtherCAT interface is available.

SPI

Value = "1": An SPI interface (NanoSPI) is available.

MTP

Value = "1": A USB interface (MTP) is available.

P-NET

Value = "1": The PROFINET (PROFIdrive) fieldbus is available.

MTCP

Value = "1": The used protocol is Modbus TCP

E-IP

Value = "1": The used protocol is EtherNet/IP™

2102h Fieldbus Module Control

Function

This object can be used to activate/deactivate certain fieldbuses (physical interfaces and protocols).

Object description

Index	2102_h
Object name	Fieldbus Module Control
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: communication
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1540
Change history	Firmware version FIR-v1626: "Savable" entry changed from "yes, category: application" to "yes, category: communication".

Description

Object 2103_h:1_h contains all physical interfaces/protocols that can be activated/deactivated. These can be switched in this object (2102_h). The current status of the activated fieldbuses is in object 2103_h:2_h.

The following distribution of the bits applies here:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
				E-IP	MTCP	P-NET	MTP		SPI	E-CAT	E-NET	CAN	RS232	RS485	USB

USB

Value = "1": The USB fieldbus (Modbus RTU) is available.

RS-485

Value = "1": An RS-485 interface (Modbus RTU) is available.

RS-232

Value = "1": An RS-232 interface (Modbus RTU) is available.

CAN
Value = "1": The CANopen fieldbus is available.

E-NET
Value = "1": An Ethernet interface (REST protocol) is available.

E-CAT
Value = "1": An EtherCAT interface is available.

SPI
Value = "1": An SPI interface (NanoSPI) is available.

MTP
Value = "1": A USB interface (MTP) is available.

P-NET
Value = "1": The PROFINET (PROFIdrive) fieldbus is available.

MTCP
Value = "1": The used protocol is Modbus TCP

E-IP
Value = "1": The used protocol is EtherNet/IP™

2103h Fieldbus Module Status

Function

Shows the active fieldbuses.

Object description

Index	2103_h
Object name	Fieldbus Module Status
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no

Allowed values	
Preset value	02_h

Subindex	01_h
Name	Fieldbus Module Disable Mask
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Fieldbus Module Enabled
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

Subindex 1 (Fieldbus Module Disable Mask): This subindex contains all physical interfaces and protocols that can be activated or deactivated. The set bit means that this fieldbus can be deactivated.

Subindex 2 (Fieldbus Module Enabled): This subindex contains all currently activated physical interfaces and protocols. The set bit means that the fieldbus is active.

The following distribution of the bits applies for subindices 1 and 2:

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
				E-IP	MTCP	P-NET	MTP		SPI	E-CAT	E-NET	CAN	RS232	RS485	USB

USB

Value = "1": The USB fieldbus (Modbus RTU) is available.

RS-485

Value = "1": An RS-485 interface (Modbus RTU) is available.

RS-232

Value = "1": An RS-232 interface (Modbus RTU) is available.

CAN

Value = "1": The CANopen fieldbus is available.

E-NET

Value = "1": An Ethernet interface (REST protocol) is available.

E-CAT

Value = "1": An EtherCAT interface is available.

SPI

Value = "1": An SPI interface (NanoSPI) is available.

MTP

Value = "1": A USB interface (MTP) is available.

P-NET

Value = "1": The PROFINET (PROFIdrive) fieldbus is available.

MTCP

Value = "1": The used protocol is Modbus TCP

E-IP

Value = "1": The used protocol is EtherNet/IP™

2290h PDI Control

Function

With this object, you can activate the *Plug&Drive interface*. You can find additional information in document *Function description Plug&Drive interface*.

Object description

Index	2290_h
Object name	PDI Control
Object Code	VARIABLE
Data type	UNSIGNED8
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	01_h
Firmware version	FIR-v1748-B531667
Change history	Firmware version FIR-v1748-B538662: "Access" table entry for subindex 00 changed from "read only" to "read/write".

Description

To activate the *Plug&Drive interface*, set bit 0 to "1".

2291h PDI Input

Function

If you use the *Plug&Drive interface*, you can use this object to select and start the operating mode and set the corresponding target values (target position, speed, etc.). You can find additional information in document *Function description Plug&Drive interface*.

Object description

Index	2291_h
Object name	PDI Input
Object Code	RECORD
Data type	PDI_INPUT
Savable	no
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1748-B531667
Change history	Firmware version FIR-v2013-B726332: "Savable" entry changed from "yes, category: application" to "no". Firmware version FIR-v2315-B1040535: "Data type" entry changed from "INTEGER8" to "UNSIGNED8".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h
Name	PDI Set Value 1
Data type	INTEGER32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	PDI Set Value 2
Data type	INTEGER16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	03_h

Name	PDI Set Value 3
Data type	INTEGER8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Subindex	04_h
Name	PDI Command
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

2292h PDI Output

Function

If you use the *Plug&Drive interface*, you can, in this object, read the status and a return value that is dependent on the used operating mode. You can find additional information in document *Function description Plug&Drive interface*.

Object description

Index	2292_h
Object name	PDI Output
Object Code	RECORD
Data type	PDI_OUTPUT
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1748-B531667
Change history	Firmware version FIR-v2315-B1040535: "Data type" entry changed from "INTEGER16" to "UNSIGNED16".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	TX-PDO
Allowed values	

Preset value	02_h

Subindex	01_h
Name	PDI Status
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	PDI Return Value
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

2300h NanoJ Control

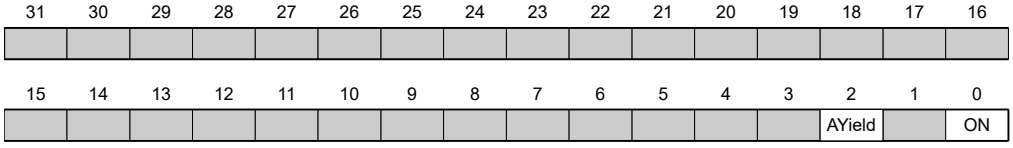
Function

Controls the execution of a *NanoJ program*.

Object description

Index	2300_h
Object name	NanoJ Control
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Control" to "NanoJ Control".

Description



ON

Switches the *NanoJ program* on (value = "1") or off (value = "0").

With a rising edge in bit 0, the program is first reloaded and the variable range reset.

NOTICE

Startup of the *NanoJ program* can take up to 200 ms.

When switching on, a check is performed to determine whether a *NanoJ program* is present. If present, "1" is entered in 2300 and the *NanoJ program* is started.

AYield (AutoYield)

If this feature is activated (bit set to "1"), the *NanoJ program* is no longer stopped if it runs longer than it is allowed to. The *NanoJ program* is, thus, no longer real-time capable and no longer runs every 1 ms (see Available computing time).

2301h NanoJ Status

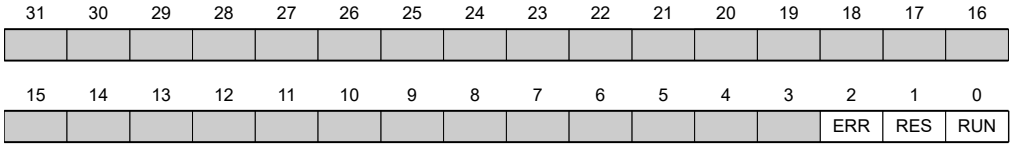
Function

Indicates the operating state of the user program.

Object description

Index	2301_h
Object name	NanoJ Status
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Status" to "NanoJ Status".

Description



RUN

Value = "0": Program is stopped, value = "1": NanoJ program is running.

RES

Reserved.

ERR

Program was ended with an error. Cause of the error can be read from object 2302h.

2302h NanoJ Error Code

Function

Indicates which error occurred during the execution of the user program.

Object description

Index	2302_h
Object name	NanoJ Error Code
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Error Code" to "NanoJ Error Code".

Description

Error codes during program execution:

Number	Description
$1xxxxyy_h$	Invalid mapping in the NanoJ program file: The value in "xxxx" specifies the index, the value in "yy" specifies the subindex of the object that should – but cannot – be mapped.
2000000_h	Invalid mapping in the NanoJ program file: too many variables of type `input` were declared (see 2310h NanoJ Input Data Selection)
3000000_h	Invalid mapping in the NanoJ program file: too many variables of type `output` were declared (see 2320h NanoJ Output Data Selection)
4000000_h	Invalid mapping in the NanoJ program file: too many variables of type `inout` were declared (see 2330h NanoJ In/output Data Selection)
0002_h	Error in memory management
0003_h	Usage fault
0004_h	Hatd fault
0005_h	Time Out: Code executed too long without yield() or sleep()
0006_h	Bus fault
1000_h	Access of a nonexistent object in the object dictionary
1002_h	An attempt was made to write a value that is too low or too high to an object.
1003_h	An attempt was made to read out an object that permits only write access.

Number	Description
$1FFF_h$	Unauthorized access of an object

Error when accessing an object:

Number	Description
$1xxxxyy_h$	Invalid mapping in the NanoJ program file: The value in "xxxx" specifies the index, the value in "yy" specifies the subindex of the object that should – but cannot – be mapped.
2000000_h + number of excess variables	Invalid mapping in the NanoJ program file: too many variables of type `input` were declared (see 2310h NanoJ Input Data Selection)
3000000_h + number of excess variables	Invalid mapping in the NanoJ program file: too many variables of type `output` were declared (see 2320h NanoJ Output Data Selection)
4000000_h + number of excess variables	Invalid mapping in the NanoJ program file: too many variables of type `inout` were declared (see 2330h NanoJ In/output Data Selection)
1000_h	Access of a nonexistent object in the object dictionary
1001_h	Write access of a write-protected entry in the OD
1002_h	An attempt was made to write a value that is too low or too high to an object.
1003_h	An attempt was made to read out an object that permits only write access.
$1FFF_h$	Unauthorized access of an object

2303h NanoJ Metadata

Function

This object is used to correctly recognize the NanoJ program by external software, e.g., *Plug & Drive Studio*.

Object description

Index	2303_h
Object name	NanoJ Metadata
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2339-B1048823
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only

PDO mapping	no
Allowed values	
Preset value	06_h

Subindex	01_h
Name	Version
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000300_h

Subindex	02_h
Name	FLASH Start Address
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	FLASH End Address
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	RAM Start Address
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	RAM End Address
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	Header Size
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

230Eh Timer

Function

This object contains the operating time in milliseconds since the last time the controller was started.

NOTICE

This object is not stored; counting begins with "0" again after switching on or an overflow.

Object description

Index	$230E_h$
Object name	Timer
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	01_h
Name	1ms Timer
Data type	UNSIGNED32
Access	read only

PDO mapping	no
Allowed values	
Preset value	00000000_h

230Fh Uptime Seconds

Function

This object contains the operating time in seconds since the last time the controller was started.

NOTICE

This object is not stored; counting begins with "0" again after switching on or an overflow.

Object description

Index	$230F_h$
Object name	Uptime Seconds
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1436
Change history	

2310h NanoJ Input Data Selection

Function

Describes the object dictionary entries that are copied to the PDO mapping input of the NanoJ program.

Object description

Index	2310_h
Object name	NanoJ Input Data Selection
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1650-B472161
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Input Data Selection" to "NanoJ Input Data Selection".

	Firmware version FIR-v1650-B472161: "Savable" entry changed from "yes, category: application" to "no". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 00 changed from "read/write" to "read only". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 01 changed from "read/write" to "read only".

Value description

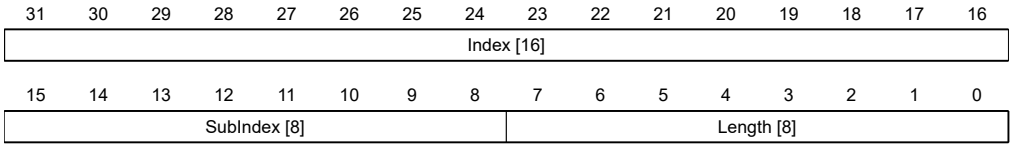
Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h - 10_h
Name	Mapping #1 - #16
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

Each subindex (1–16) describes a different mapped object.

A mapping entry consists of four bytes, which are structured according to the following graphic.



Index [16]

This contains the index of the object to be mapped

Subindex [8]

This contains the subindex of the object to be mapped

Length [8]

This contains the length of the object to be mapped in units of bits.

2320h NanoJ Output Data Selection

Function

Describes the object dictionary entries that are copied into the output PDO mapping of the *NanoJ program* after it is executed.

Object description

Index	2320_h
Object name	NanoJ Output Data Selection
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1650-B472161
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Output Data Selection" to "NanoJ Output Data Selection". Firmware version FIR-v1650-B472161: "Savable" entry changed from "yes, category: application" to "no". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 00 changed from "read/write" to "read only". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 01 changed from "read/write" to "read only".

Value description

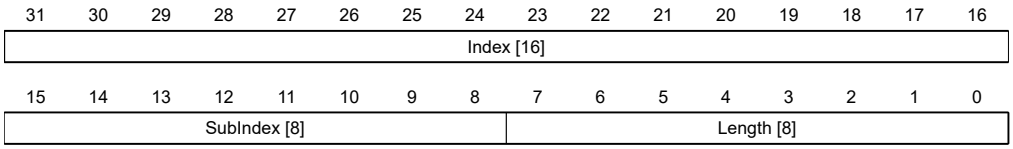
Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h - 10_h
Name	Mapping #1 - #16
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

Each subindex (1–16) describes a different mapped object.

A mapping entry consists of four bytes, which are structured according to the following graphic.



Index [16]

This contains the index of the object to be mapped

Subindex [8]

This contains the subindex of the object to be mapped

Length [8]

This contains the length of the object to be mapped in units of bits.

2330h NanoJ In/output Data Selection

Function

Describes the object dictionary entries that are first copied to the input PDO mapping of the NanoJ program and, after it is executed, are copied back to the output PDO mapping.

Object description

Index	2330_h
Object name	NanoJ In/output Data Selection
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read / write
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1650-B472161
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM In/output Data Selection" to "NanoJ In/output Data Selection". Firmware version FIR-v1650-B472161: "Savable" entry changed from "yes, category: application" to "no". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 00 changed from "read/write" to "read only". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 01 changed from "read/write" to "read only".

Value description

Subindex	00_h

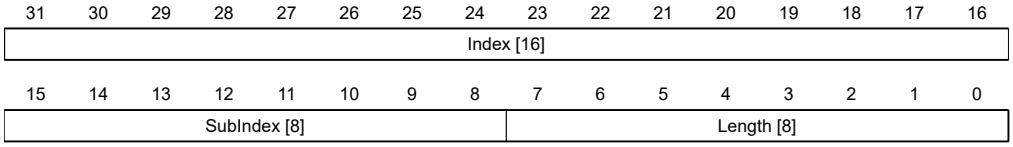
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	10_h

Subindex	01_h - 10_h
Name	Mapping #1 - #16
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

Each subindex (1–16) describes a different mapped object.

A mapping entry consists of four bytes, which are structured according to the following graphic.



Index [16]

This contains the index of the object to be mapped

Subindex [8]

This contains the subindex of the object to be mapped

Length [8]

This contains the length of the object to be mapped in units of bits.

2400h NanoJ Inputs

Function

Located here is an array with 32, 32-bit integer values that is not used within the firmware and serves only for communicating with the user program via the fieldbus.

Object description

Index	2400_h
Object name	NanoJ Inputs
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Firmware version	FIR-v1426
Change history	The number of entries was changed from 2 to 33

	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Inputs" to "NanoJ Inputs". Firmware version FIR-v1436: "Name" entry changed from "VMM Input N#" to "NanoJ Input N#".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	20_h

Subindex	01_h - 20_h
Name	NanoJ Input #1 - #32
Data type	INTEGER32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Description

Here, it is possible to pass, e.g., preset values, to the *NanoJ program*.

2500h NanoJ Outputs

Function

Located here is an array with 32, 32-bit integer values that is not used within the firmware and serves only for communicating with the user program via the fieldbus.

Object description

Index	2500_h
Object name	NanoJ Outputs
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1436: "Object Name" entry changed from "VMM Outputs" to "NanoJ Outputs". Firmware version FIR-v1436: "Name" entry changed from "VMM Output N#" to "NanoJ Output N#".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	20_h

Subindex	01_h - 20_h
Name	NanoJ Output #1 - #32
Data type	INTEGER32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Description

Here, the *NanoJ program* can store results which can then be read out via the fieldbus.

2701h Customer Storage Area

Function

Data can be deposited and stored in this object.

Object description

Index	2701_h
Object name	Customer Storage Area
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: customer
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	Firmware version FIR-v1540: "Data Type" entry changed from "UNSIGNED32" to "UNSIGNED8".

Value description

Subindex	00_h
Name	Number Of Entries

Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	FE_h

Subindex	01_h - FE_h
Name	Storage #1 - #254
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

2800h Bootloader And Reboot Settings

Function

With this object, a reboot of the firmware can be triggered.

Object description

Index	2800_h
Object name	Bootloader And Reboot Settings
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	03_h

Subindex	01_h

Name	Reboot Command
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Reboot Delay Time In Ms
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000064_h

Subindex	03_h
Name	Bootloader HW Config
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 01_h: If the value "$746F6F62_h$" is entered here, the firmware is rebooted.
- 02_h: Time in milliseconds: delays the reboot of the firmware by the respective time.

306Ch Velocity Actual Internal Value

Function

Contains the current actual speed in rpm. Compared to 606Ch Velocity Actual Value, the value is more strongly filtered and is used internally by the velocity controller and for the voltage feed forward and dead time compensation.

Object description

Index	$306C_h$
Object name	Velocity Actual Internal Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Firmware version	FIR-v2412-B1057638
Change history	

3202h Motor Drive Submode Select

Function

Controls the controller mode, such as the changeover between *closed-loop* / *open-loop* and whether Velocity Mode is simulated via the S-controller or functions with a real V-controller in *closed loop*.

Object description

Index	3202_h
Object name	Motor Drive Submode Select
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: motor
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1540: "Savable" entry changed from "yes category: application" to "yes, category: travel". Firmware version FIR-v1540: "Savable" entry changed from "yes category: travel" to "yes, category: movement". Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: movement" to "yes, category: motor".

Description

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
									BLDC	Torque			Brake	VoP	CL/OL

CL/OL

Changeover between *open-loop* and *closed-loop* (see chapter Control modes)

- Value = "0": *open-loop*
- Value = "1": *closed loop*

Toggling is not possible in the *Operation enabled* state.

VoP

Value = "1": Simulate V-controller with a P-ramp: simulate the speed modes through continuous position changes

Brake

Value = "1": Switch on automatic brake control.

Torque

only active in operating modes Profile Torque and Cyclic Synchronous Torque

Value = "1": M-controller is active, otherwise a V-controller is superimposed: no V-controller is used in the torque modes for speed limiting, thus object 6080_h is ignored; the 321Bh Velocity Controller Parameters have no effect on the control.

BLDC

Value = "1": Motor type "BLDC" (brushless DC motor)

3203h Feedback Selection

Function

In this object, the sources of the presets are defined for the commutation and the velocity and position control.

A value change in the *Operation enabled* state shows no immediate effect. Value changes in objects are buffered and read out upon changing to the *Operation enabled* state.

Object description

Index	3203_h
Object name	Feedback Selection
Object Code	ARRAY
Data type	UNSIGNED8
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1748-B538662
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h
Name	1st Feedback Interface
Data type	UNSIGNED8
Access	read / write

PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Subindex	02_h
Name	2nd Feedback Interface
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Subindex	03_h
Name	3rd Feedback Interface
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Subindex	04_h
Name	4th Feedback Interface
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Description

The subindices have the following function:

- 00_h: Value="1" to "n", where "n" is the number of existing feedbacks.
- n_h:
  Subindex n contains a bit mask for the respective feedback n. The bits have the following meaning here:
- Bit 0: If the bit is set to "1", this sensor is used for position feedback.
- Bit 1: If the bit is set to "1", this sensor is used for velocity feedback.
- Bit 2: If the bit is set to "1", this sensor is used for commutation feedback in Closed-Loop.

Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

Which sensor the controller takes into account for the individual controllers (commutation, velocity, position) is implicitly specified by the order of the sensors.

The search always begins with sensor 2 and continues in ascending order until all existing sensors have been queried. If a sensor is found whose feedback is set, it is assigned to the corresponding controller and the search ended.

NOTICE

If bit 0 in 3202_h is set to "0", *closed loop* is deactivated; bit 2 (commutation) then has no meaning. Bit 1 for the velocity and bit 0 for the position in the respective subindices are still used for the display of the actual position and speed values.

3204h Feedback Mapping

Function

This object contains information on the existing feedbacks.

Object description

Index	3204_h
Object name	Feedback Mapping
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1748-B538662
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Index Of 1st Feedback Interface
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	3380_h

Subindex	02_h
Name	Index Of 2nd Feedback Interface

Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	3390_h

Subindex	03_h
Name	Index Of 3rd Feedback Interface
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	$33A0_h$

Subindex	04_h
Name	Index Of 4th Feedback Interface
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	$33B0_h$

Description

The subindices have the following function:

- 00_h: Value="1" to "n", where "n" is the number of existing feedbacks.
- n_h:
  Subindex n refers to the index of the respective object for the configuration of the corresponding feedback.
  Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

3205h Feedback Use

Function

This object shows which sensor is currently used for which control circuit.

Object description

Index	3205_h
Object name	Feedback Use
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	

Preset value	
Firmware version	FIR-v2412-B1057638
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Sensor For Position Control Loop
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Sensor For Velocity Control Loop
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Sensor For Current Control Loop
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Sensor For Pulse Generator
Data type	UNSIGNED16
Access	read only
PDO mapping	TX-PDO

Allowed values	
Preset value	0000_h

320Dh Moment Of Inertia

Function

This factor is used for calculating the acceleration feed forward (see 321D). Default is 0 (feed forward inactive).

Acceleration feed forward applies during deceleration as well.

Object description

Index	$320D_h$
Object name	Moment Of Inertia
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1825-B577172
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: movement" to "yes, category: application". Firmware version FIR-v2508-B1072143: "Object Name" entry changed from "Torque Of Inertia Factor" to "Moment Of Inertia". Firmware version FIR-v2508-B1072143: "Name" entry changed from "Current" to "Torque [‰]".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Torque [‰]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	

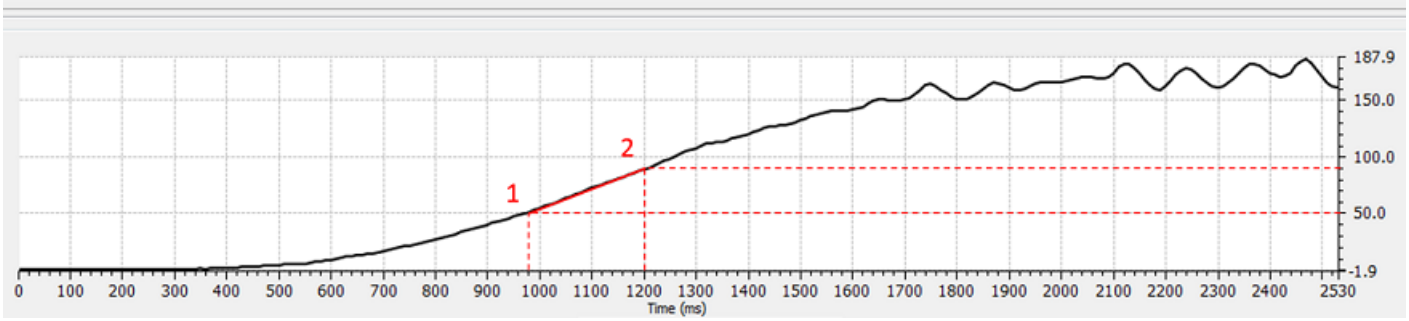
Preset value	00000000_h

Subindex	02_h
Name	Acceleration
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The value is dependent on the inertia of the load. To determine the factor:

1. Activate *closed loop* and select the *profile torque* mode.
2. Set a target for the torque and enter the value in $320D_h:01_h$.
3. Record (e. g., in *Plug & Drive Studio*) the current speed (object $606C_h$). Calculate the acceleration in the set user-defined units for the speed range, where this is constant. Enter the value in $320D_h:02_h$.
   Using the speed curve in the following figure as an example:
   (90-50)/(1200-980)=182 rpm/s.



3211h Motor Drive Set Point

Function

For reading out the Id/Iq and Ud/Uq set points,

Object description

Index	3211_h
Object name	Motor Drive Set Point
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v2451-B1068465
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Id Set Point [mA]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Iq Set Point [mA]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Ud Set Point [mV]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	Uq Set Point [mV]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

3219h Current Configuration

Function

Contains various current settings.

Object description

Index	3219_h
Object name	Current Configuration
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2451-B1068465
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	05_h

Subindex	01_h
Name	I²t Duration Of Max Current [ms]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03E8_h$

Subindex	02_h
Name	Open Loop Idle State Detection Time [ms]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03E8_h$

Subindex	03_h
Name	Open Loop Idle State Current [‰]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$01F4_h$

Subindex	04_h
Name	Block Detection Time [ms]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$00C8_h$

Subindex	05_h
Name	Block Detection Threshold [‰]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$02BC_h$

Description

The functions are as follows:

- Subindex 01_h: Maximum duration of the maximum current (6073_h) in milliseconds. Only relevant if 6073_h > 1000‰.
- Subindex 02_h: Time in milliseconds that the motor must be at a standstill before current reduction is activated.
- Subindex 03_h: Reduced current as tenths of a percent of the rated current (6075_h) if the motor is at a standstill in *open-loop*.
- Subindex 04_h: Time in milliseconds that the motor is to continue to travel against the block after block detection (see *homing on block* in mode Homing).
- Subindex 05_h: Current limit value in tenths of a percent of the rated current (6075_h) above which blocking is to be detected (see *Homing on block* in mode Homing).

321Ah Current Controller Parameters

Function

Contains the parameters for the current controller (commutation). As a rule, the values for Iq (subindex 01_h/02_h) and Id (subindex 03_h/04_h) should be the same. See chapter Controller structure.

Object description

Index	$321A_h$
Object name	Current Controller Parameters

Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2213-B1028181
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Proportional Gain Kp For Iq [mV/A]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$00001DB0_h$

Subindex	02_h
Name	Integrator Time Ti For Iq [µs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000018BD_h$

Subindex	03_h
Name	Proportional Gain Kp For Id [mV/A]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$00001DB0_h$

Subindex	04_h
Name	Integrator Time Ti For Id [µs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000018BD_h$

321Bh Velocity Controller Parameters

Function

Contains the parameters for the velocity controller. See chapter Controller structure.

Object description

Index	$321B_h$
Object name	Velocity Controller Parameters
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2213-B1028181
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Proportional Gain Kp [mA/Hz]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000140_h

Subindex	02_h
Name	Integrator Time Ti [µs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$0000C350_h$

321Ch Position Controller Parameters

Function

Contains the parameters for the position controller. See chapter Controller structure.

Object description

Index	$321C_h$
Object name	Position Controller Parameters
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2213-B1028181
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Proportional Gain Kp [Hz]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$0000008F_h$

Subindex	02_h
Name	Integrator Time Ti [µs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

321Dh Feedforward

Function

Contains the parameters for the feed forward. See chapter Controller structure.

Object description

Index	$321D_h$
Object name	Feedforward
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2213-B1028181
Change history	Firmware version FIR-v2315-B1040535: "Data type" entry changed from "UNSIGNED32" to "UNSIGNED16". Firmware version FIR-v2315-B1040535: "Data type" entry changed from "UNSIGNED32" to "UNSIGNED16". Firmware version FIR-v2315-B1040535: "Data type" entry changed from "UNSIGNED32" to "UNSIGNED16". Firmware version FIR-v2315-B1040535: "Data type" entry changed from "UNSIGNED32" to "UNSIGNED16". Firmware version FIR-v2412-B1057638: "Object Name" entry changed from "Pre-control" to "Feedforward". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Voltage Pre-control For Dq-decoupling [‰]" to "Voltage Feedforward For Dq-decoupling [‰]". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Acceleration Pre-control [‰]" to "Acceleration Feedforward [‰]". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Velocity Pre-control [‰]" to "Velocity Feedforward [‰]". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Ohmic Based Voltage Pre-control [‰]" to "Ohmic Based Voltage Feedforward [‰]".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Voltage Feedforward For Dq-decoupling [‰]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03E8_h$

Subindex	02_h
Name	Acceleration Feedforward [‰]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03E8_h$

Subindex	03_h
Name	Velocity Feedforward [‰]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$03E8_h$

Subindex	04_h
Name	Ohmic Based Voltage Feedforward [‰]
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

321Eh Voltage Limit

Function

Maximum permissible PWM voltage (duty cycle) in millivolt. See also chapter Controller structure.

Object description

Index	$321E_h$
Object name	Voltage Limit
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000186A0_h$
Firmware version	FIR-v2213-B1028181
Change history	

Description

Also dependent on this value is whether the *overmodulation* of the voltage vector is used. If *overmodulation* is used, a higher torque can be achieved. The resulting voltage is no longer sinusoidal, which can result in harmonics and higher losses.

Value in mV	Overmodulation
1001…U_{o_low}	None; the voltage vector describes a circle.
U_{o_low}…U_{o_high}	The voltage vector describes a circle that is increasingly flattened on four/six sides in proportion to the set value.
≥U_{o_high}	Full; the voltage vector describes a square or a hexagon.

U_{o_low}

The lowest voltage above which overmodulation occurs. Is calculated as follows (small deviations possible depending on the hardware):

Operating voltage*0.95

U_{o_high}

The maximum overmodulation occurs above this voltage. Is calculated as follows (small deviations possible depending on the hardware):

With two-phase stepper motors: operating voltage*1.128

With three-phase BLDC motors: operating voltage*1.05

3220h Analog Input Digits

Function

Displays the instantaneous values of the analog inputs in *ADC digits*.

Object description

Index	3220_h
Object name	Analog Input Digits
Object Code	ARRAY
Data type	INTEGER16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Analog Input Digits
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h - 02_h
Name	Analog Input #1 - #2
Data type	INTEGER16
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h

Description

Formulas for converting from [digits] to the respective unit:

- Voltage input: x digits * 24 V / 4095 digits
- Current input (if configurable): x digits * 20 mA / 1023 digits

323Ah User Pin Settings

Function

With this object, you can configure the digital inputs/outputs as described in chapter Digital inputs and outputs.

Object description

Index	$323A_h$

Object name	User Pin Settings
Object Code	ARRAY
Data type	UNSIGNED8
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2339-B1048823
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Voltage Level Select
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Subindex	02_h
Name	Pull-Up Enable
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

Description

- Subindex 01_h: Here, you define the level for the inputs/outputs:
  - Value "0": 5 V
  - Value "1": 24 V (inputs) or +UB (outputs)

NOTICE

For the inputs, always use a voltage that is smaller than the voltage +UB .

- Subindex 02_h: Here, you define the type of digital inputs:
  - Value "0" (Pull-Down): High level at 5/24 V on the pin.
  - Value "1" (Pull-Up): High level without external voltage on the pin.

3241h Digital Input Position Capture

Function

With this object, the sensor position can be noted automatically if a level change occurs at the digital input of the home switch or at two other inputs. See chapter Touch Probe (capture).

Object description

Index	3241_h
Object name	Digital Input Position Capture
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1446
Change history	Firmware version FIR-v1446: "Data type" entry changed from "UNSIGNED32" to "UNSIGNED8". Firmware version FIR-v1738-B501312: "Name" entry changed from "Encoder Raw Value" to "Sensor Raw Value". Firmware version FIR-v1748-B531667: "PDO mapping" table entry for subindex 00 changed from "no" to "TX-PDO". Firmware version FIR-v1748-B531667: "PDO mapping" table entry for subindex 01 changed from "RX-PDO" to "TX-PDO". Firmware version FIR-v1748-B531667: "PDO mapping" table entry for subindex 02 changed from "RX-PDO" to "TX-PDO". Firmware version FIR-v1748-B531667: "PDO mapping" table entry for subindex 03 changed from "RX-PDO" to "TX-PDO". Firmware version FIR-v1748-B531667: "PDO mapping" table entry for subindex 04 changed from "RX-PDO" to "TX-PDO".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only

PDO mapping	TX-PDO
Allowed values	
Preset value	$0C_h$

Subindex	01_h
Name	Control For Capture Of Home Switch
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Capture Count For Capture Of Home Switch
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Position Value For Capture Of Home Switch
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	Sensor Raw Value For Capture Of Home Switch
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	Control For Capture Of Input #3
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	Capture Count For Capture Of Input #3
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	07_h
Name	Position Value For Capture Of Input #3
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	Sensor Raw Value For Capture Of Input #3
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	09_h
Name	Control For Capture Of Input #4
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	$0A_h$
Name	Capture Count For Capture Of Input #4
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	$0B_h$
Name	Position Value For Capture Of Input #4
Data type	UNSIGNED32

Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	$0C_h$
Name	Sensor Raw Value For Capture Of Input #4
Data type	UNSIGNED32
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Description

- Subindex 01_h, 05_h, 09_h: This is used to select the type of level change:
  - Deactivate function: Value "0"
  - With rising edge: Value "1"
  - With falling edge: Value "2"
  - Both edges: Value "3"
- Subindex 02_h. 06_h, $0A_h$: Specifies the number of the noted level changes since the time the function was started; is reset to 0 if subindex 01_h is set to 1, 2 or 3
- Subindex 03_h, 07_h, $0B_h$: Encoder position of the level change (in absolute user units as in 6064_h)
- Subindex 04_h, 08_h, $0C_h$: Encoder position of the level change (in sensor increments as in 6063_h)

3242h Digital Input Routing

Function

This object determines the source of the input routing that ends in $60FD_h$.

Object description

Index	3242_h
Object name	Digital Input Routing
Object Code	ARRAY
Data type	UNSIGNED8
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1504
Change history	

Value description

Subindex	00_h

Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	20_h

Subindex	01_h
Name	Input Source For Bit #0 In 60FDh - Negative Limit Switch
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	02_h
Name	Input Source For Bit #1 In 60FDh - Positive Limit Switch
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	03_h
Name	Input Source For Bit #2 In 60FDh - Home Switch
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	04_h
Name	Input Source For Bit #3 In 60FDh - Interlock
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	05_h
Name	Input Source For Bit #4 In 60FDh
Data type	UNSIGNED8
Access	read / write

PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	06_h
Name	Input Source For Bit #5 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	07_h
Name	Input Source For Bit #6 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	08_h
Name	Input Source For Bit #7 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	09_h
Name	Input Source For Bit #8 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	$0A_h$
Name	Input Source For Bit #9 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	$0B_h$
Name	Input Source For Bit #10 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	$0C_h$
Name	Input Source For Bit #11 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	$0D_h$
Name	Input Source For Bit #12 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	$0E_h$
Name	Input Source For Bit #13 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	$0F_h$
Name	Input Source For Bit #14 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	10_h
Name	Input Source For Bit #15 In 60FDh
Data type	UNSIGNED8

Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h

Subindex	11_h
Name	Input Source For Bit #16 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	01_h

Subindex	12_h
Name	Input Source For Bit #17 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	02_h

Subindex	13_h
Name	Input Source For Bit #18 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	03_h

Subindex	14_h
Name	Input Source For Bit #19 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	04_h

Subindex	15_h
Name	Input Source For Bit #20 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	

Preset value	05_h

Subindex	16_h
Name	Input Source For Bit #21 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	06_h

Subindex	17_h
Name	Input Source For Bit #22 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	$5A_h$

Subindex	18_h
Name	Input Source For Bit #23 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	$5B_h$

Subindex	19_h
Name	Input Source For Bit #24 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	07_h

Subindex	$1A_h$
Name	Input Source For Bit #25 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	08_h

Subindex	$1B_h$

Name	Input Source For Bit #26 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	09_h

Subindex	$1C_h$
Name	Input Source For Bit #27 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	$0A_h$

Subindex	$1D_h$
Name	Input Source For Bit #28 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	$0B_h$

Subindex	$1E_h$
Name	Input Source For Bit #29 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	$0C_h$

Subindex	$1F_h$
Name	Input Source For Bit #30 In 60FDh
Data type	UNSIGNED8
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	$0D_h$

Subindex	20_h
Name	Input Source For Bit #31 In 60FDh
Data type	UNSIGNED8
Access	read / write

PDO mapping	TX-PDO
Allowed values	
Preset value	$0E_h$

324Ah Inputs

Function

You read out the current status of the inputs from this object.

Object description

Index	$324A_h$
Object name	Inputs
Object Code	ARRAY
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2339-B1048823
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	User Inputs
Data type	UNSIGNED16
Access	read only
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Encoder Inputs
Data type	UNSIGNED16

Access	read only
PDO mapping	no
Allowed values	
Preset value	0000_h

Description

- Subindex 01_h: Shows the status of the following inputs:
  - Bits 0 to 5: Digital inputs 1 to 6 (exact number dependent on product)
  - Bits 6 and 7: Analog inputs 1 and 2 as digital input (exact number dependent on product)
- Subindex 02_h: Shows the status of the following sensor inputs:
  - Bits 0 to 2: Hall sensors 1 to 3 (if present)
  - Bits 3 to 5: Channels A, B, index of the first incremental encoder (if present)
  - Bits 6 to 8: Channels A, B index of the second incremental encoder (if present)

3250h Digital Outputs Control

Function

Object description

Index	3250_h
Object name	Digital Outputs Control
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1426: Subindex 01_h: "Name" entry changed from "Special Function Disable" to "Special Function Enable" Firmware version FIR-v1446: "Name" entry changed from "Special Function Enable" to "No Function". Firmware version FIR-v1512: The number of entries was changed from 6 to 9. Firmware version FIR-v2039: Subindex 09 added

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	

Preset value	01_h

Subindex	01_h
Name	Enable Mask [Bit0=StatusLed, Bit1=ErrorLed]
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$FFFFFFFF_h$

3252h Digital Output Routing

Function

This object assigns a signal source to an output; this signal source can be controlled with $60FE_h$. You can find details in chapter *Output Routing*.

Object description

Index	3252_h
Object name	Digital Output Routing
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	Firmware version FIR-v2529-B1076225: entry "Name" changed from "Control Bit Of 60FEh:1h And Source For Brake Output" to "Control Bit Of 60FEh:1h And Source For Brake Output". Firmware version FIR-v2529-B1076225: entry "Name" changed from "Control Bit Of 60FEh:1h And Source For Output #1" to "Control Bit Of 60FEh:1h And Source For Output #1". Firmware version FIR-v2529-B1076225: entry "Name" changed from "Control Bit Of 60FEh:1h And Source For Output #2" to "Control Bit Of 60FEh:1h And Source For Output #2". Firmware version FIR-v2529-B1076225: entry "Name" changed from "Control Bit Of 60FEh:1h And Source For Output #3" to "Control Bit Of 60FEh:1h And Source For Output #3".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8

Access	read only
PDO mapping	no
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Control Bit Of 60FEh:1h And Source For Brake Output
Data type	UNSIGNED16
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	1080_h

Subindex	02_h
Name	Control Bit Of 60FEh:1h And Source For Output #1
Data type	UNSIGNED16
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	0010_h

Subindex	03_h
Name	Control Bit Of 60FEh:1h And Source For Output #2
Data type	UNSIGNED16
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	0011_h

Subindex	04_h
Name	Control Bit Of 60FEh:1h And Source For Output #3
Data type	UNSIGNED16
Access	read / write
PDO mapping	TX-PDO
Allowed values	
Preset value	0012_h

325Ah Outputs

Function

Use this object to control the digital outputs (alternative to 60FEh Digital Outputs).

Object description

Index	$325A_h$
Object name	Outputs
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2339-B1048823
Change history	Firmware version FIR-v2412-B1057638: "Savable" entry changed from "yes, category: communication" to "yes, category: application".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	01_h
Name	User Outputs
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Description

- Subindex 01_h:
  - Bits 0 to 6: Digital outputs 1 to 7 (exact number dependent on product)
  - Bit 7: Brake output (if present)

3260h Pwm Output 0

Function

Use this object to configure the first PWM output. You must define the output as PWM output using *Output Routing*.

Object description

Index	3260_h
Object name	Pwm Output 0
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1939-B682906
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Pwm Frequency
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00002710_h

Subindex	02_h
Name	Pwm Duty Cycle
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 01_h: Frequency of the PWM signal in hertz. 50…20000
- 02_h: Duty cycle of the PWM signal: 0…100

3261h Pwm Output 1

Function

Use this object to configure the second PWM output. You must define the output as PWM output using *Output Routing*.

Object description

Index	3261_h
Object name	Pwm Output 1
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1939-B682906
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Pwm Frequency
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00002710_h

Subindex	02_h
Name	Pwm Duty Cycle
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 01_h: Frequency of the PWM signal in hertz. 50…20000
- 02_h: Duty cycle of the PWM signal: 0…100

3262h Pwm Output 2

Function

Object description

Index	3262_h
Object name	Pwm Output 2
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1939-B682906
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Pwm Frequency
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00002710_h

Subindex	02_h
Name	Pwm Duty Cycle
Data type	UNSIGNED32
Access	read / write

PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

The subindices have the following function:

- 02_h: Duty cycle of the PWM signal: 0…100

3320h Analog Input Values

Function

This object displays the instantaneous values of the analog inputs in user-defined units.

Object description

Index	3320_h
Object name	Analog Input Values
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Analog Input Values
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h - 02_h
Name	Analog Input #1 - #2
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Description

The user-defined units are made up of offset (3321_h) and scaling value (3322_h/ 3323_h). If both are still set to the default values, the value in 3320_h is specified in the *ADC Digits* unit.

Formula for converting from digits to the respective unit:

- Voltage input: x digits * 24 V / 4095 digits
- Current input (if configurable): x digits * 20 mA / 1023 digits

The following applies for the sub-entries:

- Subindex 00_h: Number of analog inputs
- Subindex 01_h: Analog value 1
- Subindex 02_h: Analog value 2 (if present)

3321h Analog Input Offsets

Function

Offset that is added to the read analog value (3220_h) before scaling (multiplier from object 3322 and divisor from object 3323_h).

Object description

Index	3321_h
Object name	Analog Input Offsets
Object Code	ARRAY
Data type	INTEGER16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1022383
Change history	

Value description

Subindex	00_h
Name	Number Of Analog Input Offsets
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h - 02_h
Name	Analog Input #1 - #2
Data type	INTEGER16
Access	read / write
PDO mapping	no

Allowed values	
Preset value	0000_h

3322h Analog Input Numerators

Function

Value by which the read analog value (3220_h, 3321_h) is multiplied before it is written in object 3320_h.

Object description

Index	3322_h
Object name	Analog Input Numerators
Object Code	ARRAY
Data type	INTEGER16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Analog Input Numerators
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h - 02_h
Name	Analog Input #1 - #2
Data type	INTEGER16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	6098_h

Description

The subindices contain:

- Subindex 01_h: Multiplier for analog input 1
- Subindex 02_h: Multiplier for analog input 2 (if present)

3323h Analog Input Denominators

Function

Value by which the read analog value (3220$_h$+ 3321$_h$) is divided before it is written in object 3320$_h$.

Object description

Index	3323$_h$
Object name	Analog Input Denominators
Object Code	ARRAY
Data type	INTEGER16
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1926-B648637
Change history	

Value description

Subindex	00$_h$
Name	Number Of Analog Input Denominators
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02$_h$

Subindex	01$_h$ - 02$_h$
Name	Analog Input #1 - #2
Data type	INTEGER16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0FFF$_h$

Description

The subindices contain:

- Subindex 01$_h$: Divisor for analog input 1
- Subindex 02$_h$: Divisor for analog input 2 (if present)

3380h Feedback Sensorless

Function

Contains measurement and configuration values that are necessary for the sensorless control and field weakening in Closed-Loop.

Object description

Index	3380_h
Object name	Feedback Sensorless
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v2013-B726332
Change history	Firmware version FIR-v2013-B726332: The number of entries was changed from 7 to 6. Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	05_h

Subindex	01_h
Name	Resistance [Ohm]
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Inductance [H]
Data type	UNSIGNED32
Access	read / write

PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Magnetic Flux [Vs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	Switch On Speed [rpm]
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000078_h

Subindex	05_h
Name	Switch Off Speed [rpm]
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000064_h

Description

The subindices have the following function:

- 01_h: Winding resistance. Float value, shown here as UNSIGNED32. Is determined by Auto setup.
- 02_h: Winding inductance. Float value, shown here as UNSIGNED32. Is determined by Auto setup.
- 03_h: Interlinking flux. Float value, shown here as UNSIGNED32. Is determined by Auto setup.
- 04_h: Switch-on speed in RPM. *Closed loop* (*sensorless*) is activated above this speed if no sensors were detected by Auto setup.
- 05_h: Switch-off speed in RPM. *Closed loop* (*sensorless*) is deactivated below this speed if no sensors were detected by Auto setup.

3390h Feedback Hall

Function

Contains configuration values for the Hall sensors. The values are determined by the Auto setup.

Object description

Index	3390_h
Object name	Feedback Hall
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1748-B531667
Change history	Firmware version FIR-v2412-B1057638: "Name" entry changed from "1st Alignment" to "Alignment Of H1 Edge While H3 Low And H2 Low". Firmware version FIR-v2412-B1057638: "Name" entry changed from "2nd Alignment" to "Alignment Of H1 Edge While H3 Low And H2 High". Firmware version FIR-v2412-B1057638: "Name" entry changed from "3rd Alignment" to "Alignment Of H1 Edge While H3 High And H2 Low". Firmware version FIR-v2412-B1057638: "Name" entry changed from "4th Alignment" to "Alignment Of H1 Edge While H3 High And H2 High". Firmware version FIR-v2412-B1057638: "Name" entry changed from "5th Alignment" to "Alignment Of H2 Edge While H3 Low And H1 Low". Firmware version FIR-v2412-B1057638: "Name" entry changed from "6th Alignment" to "Alignment Of H2 Edge While H3 Low And H1 High". Firmware version FIR-v2412-B1057638: "Name" entry changed from "7th Alignment" to "Alignment Of H2 Edge While H3 High And H1 Low". Firmware version FIR-v2412-B1057638: "Name" entry changed from "8th Alignment" to "Alignment Of H2 Edge While H3 High And H1 High". Firmware version FIR-v2412-B1057638: "Name" entry changed from "9th Alignment" to "Alignment Of H3 Edge While H2 Low And H1 Low". Firmware version FIR-v2412-B1057638: "Name" entry changed from "10th Alignment" to "Alignment Of H3 Edge While H2 Low And H1 High". Firmware version FIR-v2412-B1057638: "Name" entry changed from "11th Alignment" to "Alignment Of H3 Edge While H2 High And H1 Low". Firmware version FIR-v2412-B1057638: "Name" entry changed from "12th Alignment" to "Alignment Of H3 Edge While H2 High And H1 High". Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	$0C_h$

Subindex	01_h
Name	Alignment Of H1 Edge While H3 Low And H2 Low
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Alignment Of H1 Edge While H3 Low And H2 High
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Alignment Of H1 Edge While H3 High And H2 Low
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	04_h
Name	Alignment Of H1 Edge While H3 High And H2 High
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	05_h

Name	Alignment Of H2 Edge While H3 Low And H1 Low
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	06_h
Name	Alignment Of H2 Edge While H3 Low And H1 High
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	07_h
Name	Alignment Of H2 Edge While H3 High And H1 Low
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	08_h
Name	Alignment Of H2 Edge While H3 High And H1 High
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	09_h
Name	Alignment Of H3 Edge While H2 Low And H1 Low
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	$0A_h$
Name	Alignment Of H3 Edge While H2 Low And H1 High
Data type	UNSIGNED16
Access	read / write

PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	$0B_h$
Name	Alignment Of H3 Edge While H2 High And H1 Low
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	$0C_h$
Name	Alignment Of H3 Edge While H2 High And H1 High
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

33A0h Feedback Incremental A/B/I 1

Function

Contains configuration values for the first incremental encoder. The values are determined by the Auto setup.

Object description

Index	$33A0_h$
Object name	Feedback Incremental A/B/I 1
Object Code	ARRAY
Data type	UNSIGNED16
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors".

Value description

Subindex	00_h
Name	Number Of Entries

Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	03_h

Subindex	01_h
Name	Configuration
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Alignment
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Latency [ns]
Data type	UNSIGNED16
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h

Description

The subindices have the following function:

- 01_h (Configuration): The following bits have a meaning:
  - Bit 0: Value = "0": The encoder does not have an index. Value = "1": Encoder index exists and is to be used.
- 02_h (Alignment): This value specifies the offset between the index of the encoder and the rotor's magnets. The exact determination is possible via auto setup. The presence of this value is necessary for *closed-loop* mode with encoder.
- 03_h (Latency): Here you can enter the latency of the used encoder.

33B0h Feedback SSI 1

Function

Contains configuration values for the first SSI encoder.

Object description

Index	$33B0_h$
Object name	Feedback SSI 1
Object Code	RECORD
Data type	SSI ENCODER
Savable	yes, category: sensors
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1939-B682906
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	$0D_h$

Subindex	01_h
Name	Configuration
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	02_h
Name	Alignment
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	03_h
Name	Home Position Low
Data type	INTEGER32

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	Home Position High
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	Number Of Bits For Transfer
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	17_h

Subindex	06_h
Name	Baud Rate
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000F4240_h$

Subindex	07_h
Name	Position Bitmask Low
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$007FFFC0_h$

Subindex	08_h
Name	Position Bitmask High
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	

Preset value	00000000_h

Subindex	09_h
Name	Status Bitmask Low
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	$0A_h$
Name	Status Bitmask High
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0B_h$
Name	Status Value Low
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	$0C_h$
Name	Status Value High
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	$0D_h$
Name	Latency [ns]
Data type	INTEGER32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 01_h (Configuration):
  - Bit 0: Value = "0": Alignment has not yet been determined or is not to be used. Value = "1": Alignment exists and is to be used.
- 02_h (Alignment): This value specifies the offset between the zero position of the encoder and the rotor's magnets.
  The exact determination is only possible via auto setup. The presence of this value is necessary for *closed-loop* mode with encoder.
- 03_h (Home Position Low) and 04_h (Home Position High): The absolute encoder position after a homing has been completed is entered in these subindices.
- 05_h (Number Of Bits For Transfer): Number of bits in a message (encoder data). Maximum 64 bits.
- 06_h (Baud Rate): Baud rate of the interface in hertz. The following frequencies are supported: 3.375 MHz, 1.6875 MHz, 656.25 kHz, 843.75 kHz, 421.875 kHz, 210.9375 kHz, 105.46875 kHz . If the values are different, the valid frequency with the smallest difference is selected.
- 07_h (Position Bitmask Low) and 08_h (Position Bitmask High): In these subindices, you enter a bitmask that determines which bits of the encoder data contain the position data (see following instructions).
- 09_h (Status Bitmask Low) and $0A_h$ (Status Bitmask High): In these subindices, you enter a bitmask that determines which bits of the encoder data contain the status information (see following instructions).
- $0B_h$ (Status Value Low) and $0C_h$ (Status Value High): In these subindices, you enter a bitmask that determines which value the status information bits (subindices 09_h and $0A_h$) must have (see following instructions). A different value at this point of the encoder data is interpreted as an error by the controller.
- $0D_h$ (Latency): Latency of the encoder in nanoseconds, specified in the encoder data sheet.

To set the configuration according to your encoder:

1. Set the baud rate in subindex 06_h and the number of bits in subindex 05_h according to the encoder data sheet.
   When doing so, or when you select the encoder, take into account the pause/dead time to be kept between the data packages and the fact that the controller reads the sensor at 16 kHz (62.5 µs). For example, with an encoder pause time of 40 µs, only 22.5 µs remain for transmission, which corresponds to 18.98 bits (a maximum of 2 bytes) at a baud rate of, say, 843.75 kHz.

TIP

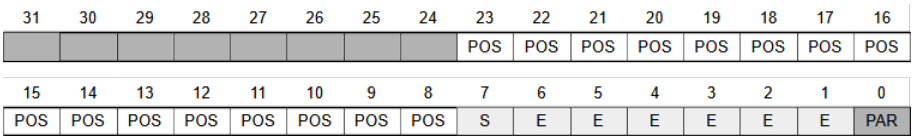
In order to keep the pause time, you can omit unused or unimportant bits at the end of the message when specifying the number of bits in subindex 05_h, such as the parity bit in the example below.

2. Define which bits the position data should include and set subindices 07_h and 08_h to the corresponding value.
3. Define which bits the status information (e. g., status, error, etc.) should include and set subindices 09_h and $0A_h$ to the corresponding value.
4. Define which value, "0" or "1", the status information bits must have and set the corresponding bits in subindices 09_h and $0A_h$ to the value.
5. Store the object by writing the value "65766173_h" in 1010_h:06_h and restart the controller.

Example

Bits 8…23 contain the position, Bit 0 is the parity bit, which is ignored by the controller. The status information is divided into the following bits:

- Bits 1…6 are error bits that should always have the value "0".
- Bit 7 is the status bit that has the value "1" if the encoder is ready.



The controller always internally adds the latch bit and rounds up to the nearest multiple of eight. The data is therefore transmitted in a 32-bit message (transmission can only occur byte by byte), if the parity bit is not omitted.

You must enter the following values in the subindices:

- 05_h (Number Of Bits For Transfer): 24_h(with the parity bit)
- 07_h(Position Bitmask Low) $FFFF00_h$
- 09_h (Status Bitmask Low): FE_h
- $0B_h$ (Status Value Low): 80_h

Subindices 08_h, $0A_h$ and $0C_h$, which would contain the most-significant 32 bits of a 64-bit message, have the value "0".

3505h Additional PROFIdrive Mapping RX

Function

See Manufacturer Telegram 900.

Object description

Index	3505_h
Object name	Additional PROFIdrive Mapping RX
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: communication
Access	read / write
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	Firmware version FIR-v2529-B1076225: entry "Object Name" changed from "Additional PROFIDRIVE Mapping RX" to "Additional PROFIdrive Mapping RX".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	01_h
Name	DO IO Data 1
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$60FE0120_h$

Subindex	02_h
Name	DO IO Data 2
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	DO IO Data 3
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	DO IO Data 4
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	DO IO Data 5
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	DO IO Data 6
Data type	UNSIGNED32

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	07_h
Name	DO IO Data 7
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	DO IO Data 8
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

3605h Additional PROFIdrive Mapping TX

Function

See Manufacturer Telegram 900.

Object description

Index	3605_h
Object name	Additional PROFIdrive Mapping TX
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: communication
Access	read / write
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2139-B1020888
Change history	

Value description

Subindex	00_h
Name	Number Of Entries

Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	01_h
Name	DO IO Data 1
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$60FD0020_h$

Subindex	02_h
Name	DO IO Data 2
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	DO IO Data 3
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	DO IO Data 4
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	05_h
Name	DO IO Data 5
Data type	UNSIGNED32
Access	read / write
PDO mapping	no

Allowed values	
Preset value	00000000_h

Subindex	06_h
Name	DO IO Data 6
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	07_h
Name	DO IO Data 7
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	DO IO Data 8
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

3700h Deviation Error Option Code

Function

The object contains the action that is to be executed if a following or slippage error is triggered.

Object description

Index	3700_h
Object name	Deviation Error Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$FFFF_h$
Firmware version	FIR-v1426

Change history	Firmware version FIR-v1738-B501312: "Object Name" entry changed from "Following Error Option Code" to "Deviation Error Option Code".

Description

Value	Description
-32768 … -2	Reserved
-1	no reaction
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely
1	Braking with *slow down ramp* (braking deceleration depending on operating mode)
2	Braking with *quick stop ramp* (6085_h)
3 … 32767	reserved

3701h Limit Switch Error Option Code

Function

If a limit switch is triggered, the limit switch position is stored internally, bit 7 (*Warning*) in 6041_h (*statusword*) is set and the CiA 402 Power State Machine is set to status *Quick Stop Active*. The action stored in this object is thereby executed. See chapter Limitation of the range of motion.

Object description

Index	3701_h
Object name	Limit Switch Error Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$FFFF_h$
Firmware version	FIR-v1748-B538662
Change history	

Description

Value in object 3701_h	Description
-2	No reaction, discard the limit switch position
-1 (factory settings)	No reaction (e. g., to execute a homing operation) except noting the limit switch position
0	Switch off driver without deceleration ramp; drive function blocked – motor can turn freely (*Switch on disabled* state)
1	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Switch on disabled*

Value in object 3701_h	Description
2	Braking with *quick stop ramp* and subsequent state change to *Switch on disabled*
5	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Quick stop active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.
6	Braking with *quick stop ramp* and subsequent state change to *Quick Stop Active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.

4014h Operating Conditions

Function

This object is used to read out the current environment values for the controller.

Object description

Index	4014_h
Object name	Operating Conditions
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1540
Change history	Firmware version FIR-v1650-B472161: "Access" table entry for subindex 01 changed from "read/write" to "read only". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 02 changed from "read/write" to "read only". Firmware version FIR-v1650-B472161: "Name" entry changed from "Temperature PCB [d?C]" to "Temperature PCB [Celsius * 10]". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 03 changed from "read/write" to "read only". Firmware version FIR-v1738-B501312: The number of entries was changed from 4 to 6. Firmware version FIR-v2451-B1068465: The number of entries was changed from 6 to 5. Firmware version FIR-v2451-B1068465: "Name" entry changed from "Temperature PCB [Celsius * 10]" to "Temperature PCB [d°C]". Firmware version FIR-v2451-B1068465: "Name" entry changed from "Temperature Motor [Celsius * 10]" to "Temperature Microcontroller Chip [d°c]".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Voltage UB Power [mV]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Voltage UB Logic [mV]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Temperature PCB [d°C]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Subindex	04_h
Name	Temperature Microcontroller Chip [d°c]
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Description

The subindices contain:

- 01_h: Current voltage supply voltage in [mV]
- 02_h: Current logic voltage in [mV]
- 03_h: Current temperature of the control board in [d°C] (tenths of degree)
- 04_h: Current temperature of the processor in [d°C] (tenths of degree)

4015h Special Drive Modes

Function

With this object, you can switch the *special drive modes* off or on. See chapter .

Object description

Index	4015_h
Object name	Special Drive Modes
Object Code	ARRAY
Data type	UNSIGNED8
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Special Drive Mode Configuration
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00_h

Subindex	02_h

Name	Virtual Config Switch Value
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00_h

Description

The subindices have the following functions:

- 01_h:
  - Value ="0"$_h$: The *special drive modes* are switched off
  - Value="2"$_h$: The *special drive modes* are switched on and the mode is set in subindex 02_h.
- 02_h: Defines the used mode.

4021h Ballast Configuration

Function

With this object, you switch the ballast circuit on or off and determine its response threshold. Furthermore, you configure the ballast monitoring. You can find details in chapter External brake chopper (ballast).

Object description

Index	4021_h
Object name	Ballast Configuration
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2013-B726332
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: application".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	08_h

Subindex	01_h
Name	Settings [Bit0: On/Off, Bit1: Polarity, Bit2: 0(Internal)/1(External)]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000004_h

Subindex	02_h
Name	UB Power Limit [mV]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000186A0_h$

Subindex	03_h
Name	UB Power Hysteresis [mV]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000001F4_h$

Subindex	04_h
Name	Nominal Resistance [mOhm]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	05_h
Name	Long Term Energy Limit [mWs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000001_h

Subindex	06_h
Name	Long Term Reference Time [ms]
Data type	UNSIGNED32

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	07_h
Name	Short Term Energy Limit [mWs]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	08_h
Name	Cooling Power [mW]
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 01_h:
  - Bit 0: Switches the ballast on (value = "1") or off (value = "0")
- 02_h: Response threshold (switch on/off) of the ballast circuit
- 03_h: Hysteresis for the response threshold (switch on/off)

4040h Drive Serial Number

Function

This object contains the serial number of the controller.

Object description

Index	4040_h
Object name	Drive Serial Number
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v1450

Change history	

4041h Device Id

Function

This object contains the ID of the device.

Object description

Index	4041_h
Object name	Device Id
Object Code	VARIABLE
Data type	OCTET_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v1540
Change history	

4042h Bootloader Infos

Object description

Index	4042_h
Object name	Bootloader Infos
Object Code	ARRAY
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v2013-B726332
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	

Preset value	03_h

Subindex	01_h
Name	Bootloader Version
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Bootloader Supported Fieldbus
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Bootloader Hw-group
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Description

The subindices have the following functions:

- 01_h: Version of the boot loader. The 4 most significant bytes contain the main version number; the 4 least significant bytes contain the minor version number. Example for version 4.2: 00040002_h
- 02_h: Fieldbuses supported by the boot loader. The bits have the same function as the bits of object 2101h Fieldbus Module Availability.

603Fh Error Code

Function

This object returns the error code of the last error that occurred.

It corresponds to the lower 16 bits of object 1003_h. For the description of the error codes, refer to object 1003_h.

Object description

Index	$603F_h$
Object name	Error Code
Object Code	VARIABLE

Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	

Description

For the meaning of the error, see object 1003_h (Pre-defined Error Field).

If the error is reset by setting bit 7 in 6040h Controlword, this object is also automatically reset to "0".

6040h Controlword

Function

This object controls the CiA 402 Power State Machine.

Object description

Index	6040_h
Object name	Controlword
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

Description

Parts of the object are, with respect to function, dependent on the currently selected mode.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
						OMS	HALT	FR	OMS [3]			EO	QS	EV	SO

SO (Switched On)

Value = "1": Switches to the "Switched on" state

EV (Enable Voltage)

Value = "1": Switches to the "Enable voltage" state

QS (Quick Stop)

Value = "0": Switches to the "Quick stop" state

EO (Enable Operation)

Value = "1": Switches to the "Enable operation" state

OMS (Operation Mode Specific)

Meaning is dependent on the selected operating mode

FR (Fault Reset)

Resets an error or a warning (if possible)

HALT

Value = "1": Triggers a halt; valid in the following modes:

- Profile Position
- Profile Velocity
- Profile Torque
- Interpolated Position Mode

6041h Statusword

Function

This object returns information about the status of the CiA 402 Power State Machine.

Object description

Index	6041_h
Object name	Statusword
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	

Description

Parts of the object are, with respect to function, dependent on the currently selected mode. Refer to the corresponding section in chapter CiA 402 operating modes and state machine.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CLA		OMS [2]		ILA	TARG	REM	SYNC	WARN	SOD	QS	VE	FAULT	OE	SO	RTSO

RTSO (Ready To Switch On)

Value = "1": Controller is in the "Ready to switch on" state

SO (Switched On)

Value = "1": Controller is in the "Switched on" state

OE (Operation Enabled)

Value = "1": Controller is in the "Operation enabled" state

FAULT
Error occurred (see 1003_h)

VE (Voltage Enabled)
Voltage applied

QS (Quick Stop)
Value = "0": Controller is in the "Quick stop" state

SOD (Switched On Disabled)
Value = "1": Controller is in the "Switched on disabled" state

WARN (Warning)
Value = "1": Warning

SYNC (synchronization)
Value = "1": Controller is in sync with the fieldbus; value = "0": Controller is not in sync with the fieldbus

REM (Remote)
Remote (value of the bit is always "1")

TARG
Target reached. The value remains at "1" even after an operating mode change until a new target is set.

ILA (Internal Limit Active)
Limit exceeded

OMS (Operation Mode Specific)
Meaning is dependent on the selected operating mode

CLA (Closed Loop Active)
Value = "1": The controller is in the *Operation enabled* state and the Closed-Loop is activated.

Listed in the following table are the bit masks that break down the state of the controller.

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

605Ah Quick Stop Option Code

Function

The object contains the action that is to be executed on a transition of the CiA 402 Power State Machine to the *Quick Stop active* state.

Object description

Index	$605A_h$
Object name	Quick Stop Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0002_h
Firmware version	FIR-v1426
Change history	

Description

Value in object $605A_h$	Description
0	Immediate stop with subsequent state change to *Switch on disabled*
1	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Switch on disabled*
2	Braking with *quick stop ramp* (6085_h) and subsequent state change to *Switch on disabled*
5	Braking with *slow down ramp* (deceleration ramp depending on operating mode) and subsequent state change to *Quick stop active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.
6	Braking with *quick stop ramp* (6085_h) and subsequent state change to *Quick Stop Active*; control does not switch off and the motor remains energized. You can switch back to the *Operation enabled* state.

In Homing mode, the deceleration ramp set in $609A_h$ (Homing Acceleration) is used instead of 6085_h.

605Bh Shutdown Option Code

Function

This object contains the action that is to be executed on a transition of the CiA 402 Power State Machine from the *Operation enabled* state to the *Ready to switch on* state.

Object description

Index	$605B_h$
Object name	Shutdown Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no

Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	

Description

Value in object $605B_h$	Description
-32768 … -1	Reserved
0	Blocking of the drive function – motor can turn freely
1	Braking with *slow down ramp* (braking deceleration depending on operating mode) and subsequent state change to *Ready to switch on*
2 … 32767	Reserved

605Ch Disable Operation Option Code

Function

This object contains the action that is to be executed on a transition of the CiA 402 Power State Machine from the *Operation enabled* state to the *Switched on* state.

Object description

Index	$605C_h$
Object name	Disable Operation Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v2412-B1057638: "Object Name" entry changed from "Disable Option Code" to "Disable Operation Option Code".

Description

Value in object $605C_h$	Description
-32768 … -1	Reserved
0	Switch off driver without deceleration ramp; drive function blocked
1	Braking with *slow down ramp* (braking deceleration depending on operating mode) and subsequent state change to *Switched on*
2 … 32767	Reserved

605Dh Halt Option Code

Function

The object contains the action that is to be executed if bit 8 (Halt) is set in controlword 6040_h.

Object description

Index	$605D_h$
Object name	Halt Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0001_h
Firmware version	FIR-v1426
Change history	

Description

Value in object $605D_h$	Description
-32768 … 0	Reserved
1	Braking with *slow down ramp* (braking deceleration depending on operating mode)
2	Braking with *quick stop ramp* (6085_h)
3 … 32767	Reserved

605Eh Fault Reaction Option Code

Function

The object contains the action specifying how the motor is to be brought to a standstill in case of an error.

Object description

Index	$605E_h$
Object name	Fault Reaction Option Code
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0002_h
Firmware version	FIR-v1426

Change history	Firmware version FIR-v2412-B1057638: "Object Name" entry changed from "Fault Option Code" to "Fault Reaction Option Code".

Description

Value in object $605E_h$	Description
-32768 … -1	Reserved
0	Blocking of the drive function – motor can turn freely
1	Braking with *slow down ramp* (braking deceleration depending on operating mode)
2	Braking with *quick stop ramp* (6085_h)
3 … 32767	Reserved

6060h Modes Of Operation

Function

The desired operating mode is entered in this object.

Object description

Index	6060_h
Object name	Modes Of Operation
Object Code	VARIABLE
Data type	INTEGER8
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

Description

Mode	Description
-2	Auto setup
-1	Clock-direction mode
0	No mode change/no mode assigned
1	Profile Position Mode
3	Profile Velocity Mode
4	Profile Torque Mode
5	Reserved
6	Homing Mode

Mode	Description
7	Interpolated Position Mode
8	Cyclic Synchronous Position Mode
9	Cyclic Synchronous Velocity Mode
10	Cyclic Synchronous Torque Mode

6061h Modes Of Operation Display

Function

Indicates the current operating mode. See also 6060h Modes Of Operation.

Object description

Index	6061_h
Object name	Modes Of Operation Display
Object Code	VARIABLE
Data type	INTEGER8
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00_h
Firmware version	FIR-v1426
Change history	

6062h Position Demand Value

Function

Indicates the current demand position in user-defined units.

Object description

Index	6062_h
Object name	Position Demand Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

6063h Position Actual Internal Value

Function

Contains the current actual position in encoder increments. Unlike objects 6062_h and 6064_h, this value is not set to "0" following a Homing operation. The source is determined in 3203h Feedback Selection.

NOTICE

If the encoder resolution in object $60E6_h$ = zero, the numerical values of this object are invalid.

Object description

Index	6063_h
Object name	Position Actual Internal Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

6064h Position Actual Value

Function

Contains the current actual position in user-defined units. The source is determined in 3203h Feedback Selection.

Object description

Index	6064_h
Object name	Position Actual Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

6065h Following Error Window

Function

Defines the maximum allowed following error in user-defined units symmetrically to the demand position.

Object description

Index	6065_h
Object name	Following Error Window
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000100_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1504: "Savable" entry changed from "no" to "yes, category: application".

Description

If the actual position deviates so much from the demand position that the value of this object is exceeded, bit 13 in object 6041_h is set. The deviation must last longer than the time in object 6066_h.

If the value of the "Following Error Window" is set to "FFFFFFFF"$_h$, following error monitoring is switched off.

A reaction to the following error can be set in object 3700_h. If a reaction is defined, an error is also entered in object 1003_h.

6066h Following Error Time Out

Function

Time in milliseconds until a larger following error results in an error message.

Object description

Index	6066_h
Object name	Following Error Time Out
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0064_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1504: "Savable" entry changed from "no" to "yes, category: application".

Description

If the actual position deviates so much from the demand position that the value of object 6065_h is exceeded, bit 13 in object 6041_h is set. The deviation must persist for longer than the time defined in this object.

A reaction to the following error can be set in object 3700_h. If a reaction is defined, an error is also entered in object 1003_h.

6067h Position Window

Function

Specifies a range symmetrical to the target position within which that target is considered having been met in modes Profile Position and Interpolated Position Mode.

Object description

Index	6067_h
Object name	Position Window
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$0000000A_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1504: "Savable" entry changed from "no" to "yes, category: application".

Description

If the current position deviates from the target position by less than the value of this object, bit 10 in object 6041_h is set. The condition must be satisfied for longer than the time defined in object 6068_h.

If the value is set to "FFFFFFFF"$_h$, monitoring is switched off.

6068h Position Window Time

Function

The current position must be within the "Position Window" (6067_h) for this time in milliseconds for the target position to be considered having been met in the Profile Position and Interpolated Position Mode modes.

Object description

Index	6068_h
Object name	Position Window Time
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO

Allowed values	
Preset value	0064_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1504: "Savable" entry changed from "no" to "yes, category: application".

Description

If the current position deviates from the target position by less than the value of object 6067_h, bit 10 in object 6041_h is set. The condition must be satisfied for longer than the time defined in object 6068_h.

606Bh Velocity Demand Value

Function

Speed specification in user-defined units for the velocity controller.

Object description

Index	$606B_h$
Object name	Velocity Demand Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

Description

This object contains the output of the ramp generator, which simultaneously serves as the preset value for the velocity controller.

606Ch Velocity Actual Value

Function

Current actual speed in user-defined units.

Object description

Index	$606C_h$
Object name	Velocity Actual Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only

PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

606Dh Velocity Window

Function

Specifies a symmetrical range relative to the target speed within which the target is considered having been met in the Profile Velocity mode.

Object description

Index	$606D_h$
Object name	Velocity Window
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$001E_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1614: "Savable" entry changed from "no" to "yes, category: application".

Description

If the current speed deviates from the set speed by less than the value of this object, bit 10 in object 6041_h is set. The condition must be satisfied for longer than the time defined in object $606E_h$ (see also statusword in Profile Velocity Mode).

606Eh Velocity Window Time

Function

The current speed must be within the "Velocity Window" ($606D_h$) for this time (in milliseconds) for the target to be considered having been met.

Object description

Index	$606E_h$
Object name	Velocity Window Time
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO

Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1614: "Savable" entry changed from "no" to "yes, category: application".

Description

Description

If the current speed deviates from the set speed by less than the value of object $606D_h$, bit 10 in object 6041_h is set. The condition must be satisfied for longer than the time defined in object 606E (see also statusword in Profile Velocity Mode).

606Fh Velocity Threshold

Function

Speed in user-defined units above which the actual speed in Profile Velocity mode is considered to be nonzero.

Object description

Index	$606F_h$
Object name	Velocity Threshold
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2013-B726332
Change history	

Description

If the actual speed is greater than the value in $606F_h$(Velocity Threshold) for a time of 6070_h(Velocity Threshold Time), bit 12 in 6041_h(Statusword) has the value "0". The bit otherwise remains set to "1".

6070h Velocity Threshold Time

Function

Time in milliseconds above which an actual speed greater than the value in $606F_h$ in Profile Velocity mode is considered to be nonzero.

Object description

Index	6070_h
Object name	Velocity Threshold Time

Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v2013-B726332
Change history	

Description

If the actual speed is greater than the value in $606F_h$(Velocity Threshold) for a time of 6070_h(Velocity Threshold Time), bit 12 in 6041_h(Statusword) has the value "0". The bit otherwise remains set to "1".

6071h Target Torque

Function

This object contains the target torque for the Profile Torque and Cyclic Synchronous Torque modes in tenths of a percent of the rated torque.

Object description

Index	6071_h
Object name	Target Torque
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$000A_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

Description

This object is calculated as thousandths of the torque, e.g., the value "500" means "50%" of the rated torque; "1100" is equivalent to 110%. The rated torque corresponds to the rated current in object 6075_h.

The minimum of 6073_h and 6072_h is used as limit for the torque in 6071_h.

6072h Max Torque

Function

The object describes the maximum torque for the Profile Torque and Cyclic Synchronous Torque modes in tenths of a percent of the rated torque.

Object description

Index	6072_h
Object name	Max Torque
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0064_h
Firmware version	FIR-v1426
Change history	

Description

This object is calculated as thousandths of the torque, e.g., the value "500" means "50%" of the rated torque; "1100" is equivalent to 110%. The rated torque corresponds to the rated current in object 6075_h.

The minimum of 6073_h and 6072_h is used as limit for the torque in 6071_h.

6073h Max Current

Function

Contains the maximum current in tenths of a percent of the set rated current. Is limited by the maximum motor current). See also I2t Motor overload protection.

NOTICE

For stepper motors, only the rated current is specified, not a maximum current. Therefore, the value of 6073_h should generally not exceed the value 1000 (100%).

Object description

Index	6073_h
Object name	Max Current
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: motor
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$03E8_h$
Firmware version	FIR-v1825-B577172
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: movement" to "yes, category: motor".

Description

The maximum current is calculated in tenths of a percent of the rated current as follows:

(6073_h*6075_h)/1000

The unit is mA DC, equivalent to the current for a block commutation, as is typically specified in the motor data sheet.

The maximum current determines:

- the maximum current for the I2t Motor overload protection
- the rated current in *open-loop* mode.

6074h Torque Demand

Function

Current torque set value requested by the ramp generator in tenths of a percent of the rated torque for the internal controller.

Object description

Index	6074_h
Object name	Torque Demand
Object Code	VARIABLE
Data type	INTEGER16
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	

Description

This object is calculated as thousandths of the torque, e.g., the value "500" means "50%" of the rated torque; "1100" is equivalent to 110%. The rated torque corresponds to the rated current in object 6075_h.

The minimum of 6073_h and 6072_h is used as limit for the torque in 6071_h.

6075h Motor Rated Current

Function

Contains the rated current in mA DC, equivalent to the current for a block commutation, as is typically specified in the motor data sheet.

Object description

Index	6075_h
Object name	Motor Rated Current
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: motor

Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000708_h
Firmware version	FIR-v1738-B501312
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: motor".

6077h Torque Actual Value

Function

This object indicates the current torque value in tenths of a percent of the rated torque for the internal controller.

Object description

Index	6077_h
Object name	Torque Actual Value
Object Code	VARIABLE
Data type	INTEGER16
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1540
Change history	

Description

This object is calculated as thousandths of the torque, e.g., the value "500" means "50%" of the rated torque; "1100" is equivalent to 110%. The rated torque corresponds to the rated current in object 6075_h.

The minimum of 6073_h and 6072_h is used as limit for the torque in 6071_h.

607Ah Target Position

Function

This object specifies the target position in user-defined units for the Profile Position and Cyclic Synchronous Position modes.

Object description

Index	$607A_h$
Object name	Target Position
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application

Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$00000E10_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

607Bh Position Range Limit

Function

Contains the minimum and maximum position in user-defined units.

Object description

Index	$607B_h$
Object name	Position Range Limit
Object Code	ARRAY
Data type	INTEGER32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Min Position Range Limit
Data type	INTEGER32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Max Position Range Limit
Data type	INTEGER32

Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Description

If this range is exceeded or not reached, an overflow occurs. To prevent this overflow, limit values for the target position can be set in object $607D_h$ ("Software Position Limit").

607Ch Home Offset

Function

Specifies the difference between the zero position of the controller and the reference point of the machine in user-defined units.

Object description

Index	$607C_h$
Object name	Home Offset
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

607Dh Software Position Limit

Function

Defines the limit positions relative to the reference point of the application in user-defined units.

Object description

Index	$607D_h$
Object name	Software Position Limit
Object Code	ARRAY
Data type	INTEGER32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Min Position Limit
Data type	INTEGER32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Max Position Limit
Data type	INTEGER32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Description

The absolute target position must lie within the limits set here. The Home Offset ($607C_h$) is not taken into account.

607Eh Polarity

Function

With this object, the direction of rotation can be reversed.

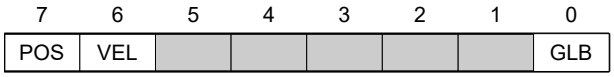
Object description

Index	$607E_h$
Object name	Polarity
Object Code	VARIABLE
Data type	UNSIGNED8
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	

Preset value	00_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1738-B501312: "PDO mapping" table entry for subindex 00 changed from "no" to "RX-PDO".

Description

The following generally applies for direction reversal: If a bit is set to the value "1", reversal is activated. If the value is "0", the direction of rotation is as described in the respective mode.



GLB (Global)

Direction of rotation reversal in all modes. It is not necessary here to either perform the auto setup again or to adjust the target values. The actual values are adjusted automatically. The change is not taken over if the *state machine* is already in the *Operation Enabled* state.

VEL (Velocity)

Direction of rotation reversal in the following modes:

- Profile Velocity Mode
- Cyclic Synchronous Velocity Mode

POS (Position)

Direction of rotation reversal in the following modes:

- Profile Position Mode
- Cyclic Synchronous Position Mode

607Fh Max Profile Velocity

Function

Specifies the maximum speed in user-defined units for which the Mod i Profile Torque, Profile Position and Profile Velocity.

Object description

Index	$607F_h$
Object name	Max Profile Velocity
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00007530_h
Firmware version	FIR-v1540

Change history	Firmware version FIR-v1738-B501312: "Object Name" entry changed from "Max profile velocity" to "Max Profile Velocity". Firmware version FIR-v1738-B501312: "Data type" entry changed from "INTEGER16" to "UNSIGNED32". Firmware version FIR-v1738-B501312: "Savable" entry changed from "no" to "yes, category: application". Firmware version FIR-v1738-B501312: "Access" table entry for subindex 00 changed from "read only" to "read/write". Firmware version FIR-v1738-B501312: "PDO mapping" table entry for subindex 00 changed from "TX-PDO" to "RX-PDO".

6080h Max Motor Speed

Function

Contains the maximum permissible speed of the motor in user-defined units.

Object description

Index	6080_h
Object name	Max Motor Speed
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00007530_h
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1614: "Savable" entry changed from "yes, category: application" to "yes, category: tuning". Firmware version FIR-v1738-B501312: "Object Name" entry changed from "Maximum Speed" to "Max Motor Speed". Firmware version FIR-v1738-B501312: "PDO mapping" table entry for subindex 00 changed from "no" to "RX-PDO". Firmware version FIR-v1748-B538662: "Savable" entry changed from "yes, category: tuning" to "yes, category: movement". Firmware version FIR-v1825-B577172: "Savable" entry changed from "yes, category: movement" to "yes, category: tuning". Firmware version FIR-v1825-B577172: "Savable" entry changed from "yes, category: tuning" to "yes, category: movement". Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: movement" to "yes, category: application".

6081h Profile Velocity

Function

Specifies the maximum travel speed in user-defined units.

Object description

Index	6081_h
Object name	Profile Velocity
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$000001F4_h$
Firmware version	FIR-v1426
Change history	

6082h End Velocity

Function

Specifies the speed at the end of the traveled ramp in user-defined units.

Object description

Index	6082_h
Object name	End Velocity
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

6083h Profile Acceleration

Function

Specifies the maximum acceleration in user-defined units.

Object description

Index	6083_h

Object name	Profile Acceleration
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$000001F4_h$
Firmware version	FIR-v1426
Change history	

6084h Profile Deceleration

Function

Specifies the maximum deceleration (deceleration ramp) in user-defined units. Is limited by $60C6_h$.

Object description

Index	6084_h
Object name	Profile Deceleration
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$000001F4_h$
Firmware version	FIR-v1426
Change history	

6085h Quick Stop Deceleration

Function

Specifies the maximum Quick Stop Deceleration in user-defined units. Depending on the operating mode, is limited by $60C6_h$ (Max Deceleration) and, if applicable, $60A4_h$ (Profile Jerk).

Object description

Index	6085_h
Object name	Quick Stop Deceleration
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	

Preset value	00001388_h
Firmware version	FIR-v1426
Change history	

6086h Motion Profile Type

Function

Specifies the ramp type for the Profile Position and Profile Velocity modes.

Object description

Index	6086_h
Object name	Motion Profile Type
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1426
Change history	

Description

Value = "0": = Trapezoidal ramp

Value = "3": Ramp with limited jerk

6087h Torque Slope

Function

This object contains the slope of the torque in Torque mode.

Object description

Index	6087_h
Object name	Torque Slope
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$000003E8_h$
Firmware version	FIR-v1426
Change history	

Description

This object is calculated as thousandths of the torque, e.g., the value "500" means "50%" of the rated torque; "1100" is equivalent to 110%. The rated torque corresponds to the rated current in object 6075$_h$.

The minimum of 6073$_h$ and 6072$_h$ is used as limit for the torque in 6071$_h$.

6091h Gear Ratio

Function

Contains the gear ratio (number of motor revolutions per revolution of the output shaft) of the encoder/sensor that is used for position control (see 3203h Feedback Selection).

Object description

Index	6091$_h$
Object name	Gear Ratio
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1738-B501312: "PDO mapping" table entry for subindex 01 changed from "no" to "RX-PDO". Firmware version FIR-v1738-B501312: "PDO mapping" table entry for subindex 02 changed from "no" to "RX-PDO".

Value description

Subindex	00$_h$
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02$_h$

Subindex	01$_h$
Name	Motor Revolutions
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001$_h$

Subindex	02$_h$
Name	Shaft Revolutions
Data type	UNSIGNED32

Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Description

Gear Ratio = Motor Revolutions (6091_h:01_h) / Shaft Revolutions (6091_h:02_h)

6092h Feed Constant

Function

Contains the feed constant (feed in user-defined units per revolution of the output shaft) of the encoder/ sensor that is used for position control (see 3203h Feedback Selection).

Object description

Index	6092_h
Object name	Feed Constant
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Feed
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Subindex	02_h
Name	Shaft Revolutions
Data type	UNSIGNED32

Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Description

Feed Constant = Feed (6092_h:01_h) / Shaft Revolutions (6092_h:02_h)

6096h Velocity Factor

Function

This object contains the factor that is used for converting from user-defined speed units. See chapter User-defined units.

Object description

Index	6096_h
Object name	Velocity Factor
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Numerator
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Subindex	02_h
Name	Divisor
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Description

The subindices have the following functions:

- 01_h: Numerator of the factor
- 02_h: Denominator of the factor

6097h Acceleration Factor

Function

This object contains the factor that is used for converting from user-defined acceleration units. See chapter User-defined units.

Object description

Index	6097_h
Object name	Acceleration Factor
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Numerator

Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Subindex	02_h
Name	Divisor
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Description

The subindices have the following functions:

- 01_h: Numerator of the factor
- 02_h: Denominator of the factor

6098h Homing Method

Function

This object defines the Homing method in Homing mode.

Object description

Index	6098_h
Object name	Homing Method
Object Code	VARIABLE
Data type	INTEGER8
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	23_h
Firmware version	FIR-v1426
Change history	

6099h Homing Speed

Function

Specifies the speeds for homing mode (6098_h) in user-defined units.

Object description

Index	6099_h
Object name	Homing Speed
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Speed During Search For Switch
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000032_h

Subindex	02_h
Name	Speed During Search For Zero
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$0000000A_h$

Description

The speed for the search for the switch is specified in subindex 1.

The (lower) speed for the search for the reference position is specified in subindex 2.

NOTICE

- The speed in subindex 2 is simultaneously the initial speed when starting the acceleration ramp. If this is set too high, the motor loses steps or fails to turn at all.
  If the setting is too high, the index marking will be overlooked, especially with high-resolution encoders. The minimum detectable width of the index pulse is 31.25 µs.
  .
- The speed in subindex 1 must be greater than the speed in subindex 2.

609Ah Homing Acceleration

Function

Specifies the acceleration ramp for homing mode in user-defined units.

Object description

Index	$609A_h$
Object name	Homing Acceleration
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	$000001F4_h$
Firmware version	FIR-v1426
Change history	

Description

The ramp is only used when starting up. When the switch is reached, the motor immediately switches to the lower speed; when the end position is reached, it immediately stops.

60A2h Jerk Factor

Function

This object contains the factor that is used for converting from user-defined jerk units. See chapter User-defined units.

Object description

Index	$60A2_h$
Object name	Jerk Factor
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	

Preset value	
Firmware version	FIR-v1738-B501312
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Numerator
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Subindex	02_h
Name	Divisor
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Description

The subindices have the following functions:

- 01_h: Numerator of the factor
- 02_h: Denominator of the factor

60A4h Profile Jerk

Function

In the case of a ramp with limited jerk, the size of the jerk in user-defined units can be entered in this object. An entry with the value "0" means that the jerk is not limited.

Object description

Index	$60A4_h$
Object name	Profile Jerk

Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1614: "Name" entry changed from "End Acceleration Jerk" to "Begin Deceleration Jerk". Firmware version FIR-v1614: "Name" entry changed from "Begin Deceleration Jerk" to "End Acceleration Jerk".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	04_h

Subindex	01_h
Name	Begin Acceleration Jerk
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Subindex	02_h
Name	Begin Deceleration Jerk
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Subindex	03_h
Name	End Acceleration Jerk
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Subindex	04_h
Name	End Deceleration Jerk
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$000003E8_h$

Description

- Subindex 01_h (*Begin Acceleration Jerk*): Initial jerk during acceleration
- Subindex 02_h (*Begin Deceleration Jerk*): Initial jerk during braking
- Subindex 03_h (*End Acceleration Jerk*): Final jerk during acceleration
- Subindex 04_h (*End Deceleration Jerk*): Final jerk during braking

60A8h SI Unit Position

Function

This object contains the position unit. See chapter User-defined units.

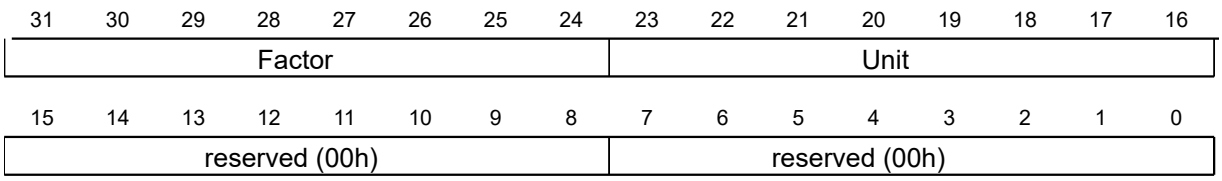
Object description

Index	$60A8_h$
Object name	SI Unit Position
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$FF410000_h$
Firmware version	FIR-v1738-B501312
Change history	

Description

Object $60A8_h$ contains:

- Bits 16 to 23: The position unit (see chapter Units)
- Bits 24 to 31: The exponent of a power of ten (see chapter Units)



60A9h SI Unit Velocity

Function

This object contains the speed unit. See chapter User-defined units.

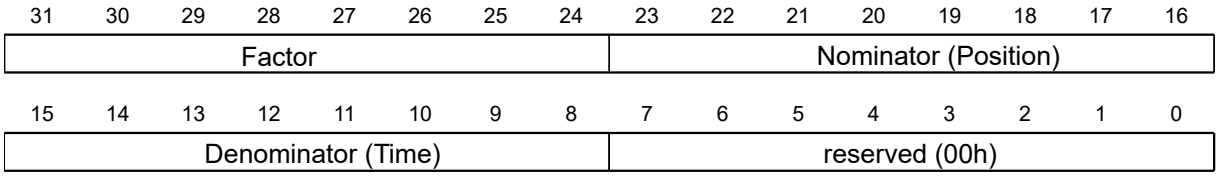
Object description

Index	$60A9_h$
Object name	SI Unit Velocity
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	no
Allowed values	
Preset value	$00B44700_h$
Firmware version	FIR-v1738-B501312
Change history	

Description

Object $60A9_h$ contains:

- Bits 8 to 15: The time unit (see chapter Units)
- Bits 16 to 23: The position unit (see chapter Units)
- Bits 24 to 31: The exponent of a power of ten (see chapter Units)



60B0h Position Offset

Function

Offset for the position set value in user-defined units. Is taken into account in mode Cyclic Synchronous Position.

Object description

Index	$60B0_h$
Object name	Position Offset
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Firmware version	FIR-v1738-B505321
Change history	

60B1h Velocity Offset

Function

Offset for the speed set value in user-defined units. Is taken into account in the Cyclic Synchronous Position, Cyclic Synchronous Velocity and Clock-direction mode modes.

Object description

Index	$60B1_h$
Object name	Velocity Offset
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1738-B505321
Change history	

60B2h Torque Offset

Function

Offset for the torque set value in tenths of a percent. Is taken into account in the Cyclic Synchronous Position, Cyclic Synchronous Velocity, Cyclic Synchronous Torque and Clock-direction mode modes.

Object description

Index	$60B2_h$
Object name	Torque Offset
Object Code	VARIABLE
Data type	INTEGER16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1738-B505321
Change history	

60C1h Interpolation Data Record

Function

This object contains the demand position in user-defined units for the interpolation algorithm for the interpolated position operating mode.

Object description

Index	$60C1_h$
Object name	Interpolation Data Record
Object Code	ARRAY
Data type	INTEGER32
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1512
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	01_h
Name	1st Set-point
Data type	INTEGER32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Description

The value is taken over at the next synchronization time.

60C2h Interpolation Time Period

Function

This object contains the interpolation time.

Object description

Index	$60C2_h$
Object name	Interpolation Time Period
Object Code	RECORD
Data type	INTERPOLATION_TIME_PERIOD
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1426
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	02_h

Subindex	01_h
Name	Interpolation Time Period Value
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	02_h
Name	Interpolation Time Index
Data type	INTEGER8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	FD_h

Description

The subindices have the following functions:

- 01_h: Interpolation time.
- 02_h: Power of ten of the interpolation time: -3 corresponds to the time basis in milliseconds

The following applies here: cycle time = value of $\underline{60C2_h}:01_h$ * 10 $^{\text{value of 60C2:02}}$ seconds.

60C4h Interpolation Data Configuration

Function

This object offers the maximum buffer size, specifies the configured buffer organization of the interpolated data and offers objects for defining the size of the record and for deleting the buffer.

It is also used to store the position of other data points.

Object description

Index	$60C4_h$
Object name	Interpolation Data Configuration
Object Code	RECORD
Data type	INTERPOLATION_DATA_CONFIGURATION
Savable	yes, category: application
Access	read only
PDO mapping	no
Allowed values	
Preset value	
Firmware version	FIR-v1512
Change history	Firmware version FIR-v1540: "Access" table entry for subindex 05 changed from "read/write" to "write only". Firmware version FIR-v1540: "Access" table entry for subindex 06 changed from "read/write" to "write only". Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application". Firmware version FIR-v1650-B472161: "Access" table entry for subindex 01 changed from "read/write" to "read only". Firmware version FIR-v2412-B1057638: "Name" entry changed from "Buffer Organization" to "Buffer Organisation".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	06_h

Subindex	01_h
Name	Maximum Buffer Size
Data type	UNSIGNED32
Access	read only
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	02_h
Name	Actual Buffer Size
Data type	UNSIGNED32
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00000000_h

Subindex	03_h
Name	Buffer Organisation
Data type	UNSIGNED8
Access	read / write
PDO mapping	no
Allowed values	
Preset value	00_h

Subindex	04_h
Name	Buffer Position
Data type	UNSIGNED16
Access	read / write
PDO mapping	no
Allowed values	
Preset value	0000_h

Subindex	05_h
Name	Size Of Data Record
Data type	UNSIGNED8
Access	write only
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	06_h
Name	Buffer Clear
Data type	UNSIGNED8

Access	write only
PDO mapping	no
Allowed values	
Preset value	00_h

Description

The value of subindex 01_h contains the maximum possible number of interpolated records.

The value of subindex 02_h contains the current number of interpolated records.

If subindex 03_h is "00_h", this means a FIFO buffer organization; if it is "01_h", it specifies a ring buffer organization.

The value of subindex 04_h is unitless and specifies the next free buffer entry point.

The value of subindex 05_h is specified in units of "byte".

If the value "00_h" is written in subindex 06_h, it deletes the received data in the buffer, deactivates access and deletes all interpolated records.

If the value "01_h" is written in subindex 06_h, it activates access to the input buffer.

60C5h Max Acceleration

Function

This object contains the maximum permissible acceleration for the Profile Position and Profile Velocity modes.

Object description

Index	$60C5_h$
Object name	Max Acceleration
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00001388_h
Firmware version	FIR-v1426
Change history	

60C6h Max Deceleration

Function

This object contains the maximum permissible deceleration (deceleration ramp) for the Profile Position, Profile Velocity and Interpolated Position Mode operating modes.

Object description

Index	$60C6_h$
Object name	Max Deceleration
Object Code	VARIABLE

Data type	UNSIGNED32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00001388_h
Firmware version	FIR-v1426
Change history	

60E4h Additional Position Actual Value

Function

Contains the current actual position of all existing feedbacks in user-defined units.

Object description

Index	$60E4_h$
Object name	Additional Position Actual Value
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	Firmware version FIR-v1748-B538662: "Data type" entry changed from "UNSIGNED32" to "INTEGER32". Firmware version FIR-v1748-B538662: "Data type" entry changed from "UNSIGNED32" to "INTEGER32".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h - 04_h
Name	Additional Position Actual Value #1 - #4
Data type	INTEGER32
Access	read only

PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 00_h: Value="1" to "n", where "n" is the number of existing feedbacks.
- n_h:
  Subindex n contains the current actual position of the corresponding feedback.
  Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

60E5h Additional Velocity Actual Value

Function

Contains the current actual speed of all existing feedbacks in user-defined units.

Object description

Index	$60E5_h$
Object name	Additional Velocity Actual Value
Object Code	ARRAY
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h - 04_h
Name	Additional Velocity Actual Value #1 - #4
Data type	INTEGER32
Access	read only
PDO mapping	TX-PDO

Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 00_h: Value="1" to "n", where "n" is the number of existing feedbacks.
- n_h:
  Subindex n contains the current actual speed of the corresponding feedback.
  Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

60E6h Additional Position Encoder Resolution - Encoder Increments

Function

With this object and with $60EB_h$, the resolution of each existing feedback is calculated.

Object description

Index	$60E6_h$
Object name	Additional Position Encoder Resolution - Encoder Increments
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1748-B538662
Change history	Firmware version FIR-v2451-B1068465: "Data type" entry changed from "INTEGER32" to "UNSIGNED32". Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors". Firmware version FIR-v2451-B1068465: "Data type" entry changed from "INTEGER32" to "UNSIGNED32".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h - 04_h
Name	Additional Position Encoder Resolution - Encoder Increments Feedback Interface #1 - #4
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Description

The subindices have the following function:

- 00_h: Value="1" to "n", where "n" is the number of existing feedbacks.
- n_h:
  Subindex n contains the number of increments of the corresponding feedback.
  Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

The resolution of feedback "n" is calculated as follows:

Position Encoder Resolution = Encoder Increments ($60E6_h$:01_h) / Motor Revolutions ($60EB_h$:02_h)

NOTICE

The value "0" in a subindex means that the respective feedback is not connected and is not used. Thus, it is possible, for Example, to switch off the sensorless function to save computing time. This can be helpful if a *NanoJ* program needs the computing time.

If a value is not equal to "0" in a subindex, the controller checks the corresponding sensor when switching on. In case of an error (signal not present, invalid configuration/state), the error bit is set in the statusword and an error code stored in object 1003h.

60EBh Additional Position Encoder Resolution - Motor Revolutions

Function

With this object and with $60E6_h$, the resolution of each existing feedback is calculated.

Object description

Index	$60EB_h$
Object name	Additional Position Encoder Resolution - Motor Revolutions
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v1738-B501312
Change history	Firmware version FIR-v2451-B1068465: "Savable" entry changed from "yes, category: tuning" to "yes, category: sensors".

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h - 04_h
Name	Additional Position Encoder Resolution - Motor Revolutions Feedback Interface #1 - #4
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000001_h

Description

The subindices have the following function:

- 00_h: Value="1" to "n", where "n" is the number of existing feedbacks.
- n_h:
  Subindex n contains the number of motor revolutions of the corresponding feedback.
  Subindex 01_h always corresponds to the first (and always existing) *sensorless* feedback. The order of the remaining feedbacks corresponds to the table in chapter Configuring the sensors.

The resolution of feedback "n" is calculated as follows:

Position Encoder Resolution = Encoder Increments ($60E6_h$:n_h) / Motor Revolutions ($60EB_h$:n_h)

60F1h Additional Encoder Inversion

Function

The polarity of the sensors is stored here.

Object description

Index	$60F1_h$
Object name	Additional Encoder Inversion
Object Code	ARRAY
Data type	UNSIGNED8
Savable	yes, category: sensors
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	
Firmware version	FIR-v2451-B1068465

Change history	

Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	RX-PDO
Allowed values	
Preset value	04_h

Subindex	01_h - 04_h
Name	Additional Encoder Inversion - Feedback Interface #1 - #4
Data type	UNSIGNED8
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00_h

60F2h Position Option Code

Function

The object describes the positioning behavior in Profile Position mode.

Object description

Index	$60F2_h$
Object name	Position Option Code
Object Code	VARIABLE
Data type	UNSIGNED16
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	0000_h
Firmware version	FIR-v1446
Change history	Firmware version FIR-v1614: "Savable" entry changed from "no" to "yes, category: application". Firmware version FIR-v2412-B1057638: "Object Name" entry changed from "Positioning Option Code" to "Position Option Code".

Description

Only the following bits are supported at the present time:

REL. OPT. (Relative Option)

These bits determine the behavior with relative rotating movement in "profile position" mode if bit 6 of controlword 6040_h = "1" is set.

Bit 1	Bit 0	Definition
0	0	Position movements are executed relative to the previous (internal absolute) target position (each relative to 0 if there is no previous target position)
0	1	Position movements are executed relative to the preset value (or output) of the ramp generator.
1	0	Position movements are performed relative to the current position (object 6064_h).
1	1	Reserved

RRO (Request-Response Option)

These bits determine the behavior when passing controlword 6040_h bit 4 ("new setpoint") – in this case, the controller releases the bit itself. This eliminates the need to externally reset the bit to "0" afterwards. After the bit is set to the value "0" by the controller, bit 12 ("setpoint acknowledgment") is also set to the value "0" in statusword 6041_h.

NOTICE

These options cause the controller to modify object controlword 6040_h.

Bit 5	Bit 4	Definition
0	0	The functionality is as described under Setting travel commands.
0	1	The controller releases the "new setpoint" bit as soon as the current targeted movement has reached its target.
1	0	The controller releases the "new setpoint" bit as soon this is possible for the controller.
1	1	Reserved

RADO (Rotary Axis Direction Option)

These bits determine the direction of rotation in "profile position" mode.

Bit 7	Bit 6	Definition
0	0	Normal positioning similar to a linear axis: If one of the "Position Range Limits" – $607B_h$:01_h and 02_h – is reached or exceeded, the preset is automatically transferred to the other end of the limit. Only with this bit combination is a movement greater than the modulo value possible.
0	1	Positioning only in negative direction: If the target position is greater than the current position, the axis moves to the target position via the "Min Position Range Limit" from object $607D_h$:01_h.

Bit 7	Bit 6	Definition
1	0	Positioning only in positive direction: If the target position is less than the current position, the axis moves to the target position via the "Max Position Range Limit" from object $607D_h$:01_h.
1	1	Positioning with the shortest distance to the target position. If the difference between the current position and the target position in a 360° system is less than 180°, the axis moves in the positive direction.

60F4h Following Error Actual Value

Function

This object contains the current following error in user-defined units.

Object description

Index	$60F4_h$
Object name	Following Error Actual Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

60F8h Max Slippage

Function

Defines the maximum allowed slippage error in user-defined units symmetrically to the set speed in Profile Velocity mode.

Object description

Index	$60F8_h$
Object name	Max Slippage
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000190_h
Firmware version	FIR-v1738-B501312

Change history	

Description

If the actual speed deviates so much from the set speed that the value (absolute value) of this object is exceeded, bit 13 in object 6041$_h$ is set. The deviation must last longer than the time in object 203F$_h$.

If the value of 60F8$_h$ is set to "7FFFFFFF"$_h$ or "80000000"$_h$, slippage error monitoring is switched off.

A reaction to the slippage error can be set in object 3700$_h$. If a reaction is defined, an error is also entered in object 1003$_h$.

60FAh Control Effort

Function

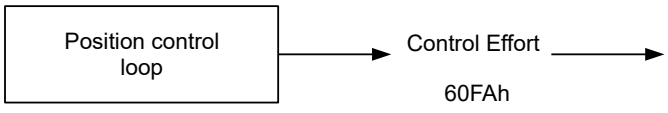
This object contains the correction speed (control variable) in user-defined units that is fed to the velocity controller by the position controller.

Object description

Index	60FA$_h$
Object name	Control Effort
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000$_h$
Firmware version	FIR-v1748-B531667
Change history	

Description

The position controller calculates a correction speed (in user-defined units) from the difference between the current position and the demand position which is then passed on to the velocity controller. This correction value is dependent on the proportional component and integral component of the position controller. See also chapter Closed-Loop.



60FCh Position Demand Internal Value

Function

Object description

Index	$60FC_h$
Object name	Position Demand Internal Value
Object Code	VARIABLE
Data type	INTEGER32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1738-B501312
Change history	

60FDh Digital Inputs

Function

With this object, the digital inputs of the motor can be read.

Object description

Index	$60FD_h$
Object name	Digital Inputs
Object Code	VARIABLE
Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	00000000_h
Firmware version	FIR-v1426
Change history	

Description

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
STO B	STO A						...	IN 8	IN 7	IN 6	IN 5	IN 4	IN 3	IN 2	IN 1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												IL	HS	PLS	NLS

NLS (Negative Limit Switch)
Negative limit switch

PLS (Positive Limit Switch)
Positive limit switch

HS (Home Switch)
Home switch

IL (Interlock)
Interlock

IN n (Input n)
Input n – the number of used bits is dependent on the given controller.

STO A
STO channel A

STO B
STO channel B

60FEh Digital Outputs

Function

With this object, the digital outputs of the motor can be written.

Object description

Index	$60FE_h$
Object name	Digital Outputs
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

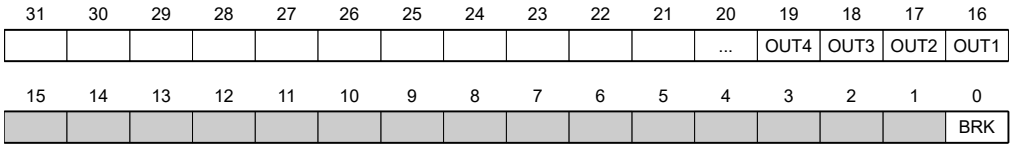
Value description

Subindex	00_h
Name	Number Of Entries
Data type	UNSIGNED8
Access	read only
PDO mapping	no
Allowed values	
Preset value	01_h

Subindex	01_h
Name	Physical Outputs
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000_h

Description

To write the outputs, the entries in object 3250$_h$, subindex 02$_h$ to 05$_h$, must also be taken into account.



BRK (Brake)

Bit for the brake output (if the controller supports this function):

Value "1" means that the brake is activated (no current can flow between the two pins of the brake connection; the brake is closed).

OUT n (Output No n)

Bit for the respective digital output; the exact number of digital outputs is dependent on the controller.

60FFh Target Velocity

Function

In this object, the target speed for the profile velocity and cyclic synchronous velocity modes is entered in user-defined units.

Object description

Index	60FF$_h$
Object name	Target Velocity
Object Code	VARIABLE
Data type	INTEGER32
Savable	yes, category: application
Access	read / write
PDO mapping	RX-PDO
Allowed values	
Preset value	00000000$_h$
Firmware version	FIR-v1426
Change history	Firmware version FIR-v1626: "Savable" entry changed from "no" to "yes, category: application".

6502h Supported Drive Modes

Function

The object describes the supported operating modes in object 6060$_h$.

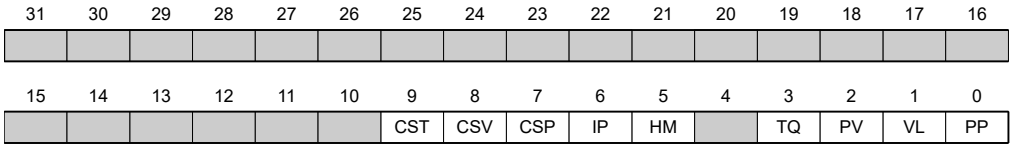
Object description

Index	6502$_h$
Object name	Supported Drive Modes
Object Code	VARIABLE

Data type	UNSIGNED32
Savable	no
Access	read only
PDO mapping	TX-PDO
Allowed values	
Preset value	000003ED$_h$
Firmware version	FIR-v1426
Change history	

Description

The set bit specifies whether the respective mode is supported. If the value of the bit is "0", the mode is not supported.



PP

Profile Position Mode

VL

Velocity Mode

PV

Profile Velocity Mode

TQ

Torque Mode

HM

Homing Mode

IP

Interpolated Position Mode

CSP

Cyclic Synchronous Position Mode

CSV

Cyclic Synchronous Velocity Mode

CST

Cyclic Synchronous Torque Mode

6503h Drive Catalogue Number

Function

Contains the device name as character string.

Object description

Index	6503_h
Object name	Drive Catalogue Number
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v1426
Change history	

6505h Http Drive Catalogue Address

Function

This object contains the manufacturer's web address as a character string.

Object description

Index	6505_h
Object name	Http Drive Catalogue Address
Object Code	VARIABLE
Data type	VISIBLE_STRING
Savable	no
Access	read only
PDO mapping	no
Allowed values	
Preset value	0
Firmware version	FIR-v1426
Change history	

12 Copyrights

12.1 Introduction

Integrated in the Nanotec software are components from products from external software manufacturers. In this chapter, you will find the copyright information regarding the used external software sources.

12.2 AES

FIPS-197 compliant AES implementation

Based on XySSL: Copyright (C) 2006-2008 Christophe Devine

Copyright (C) 2009 Paul Bakker <polarssl_maintainer at polarssl dot org>

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution; or, the application vendor's website must provide a copy of this notice.
- Neither the names of PolarSSL or XySSL nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The AES block cipher was designed by Vincent Rijmen and Joan Daemen.

http://csrc.nist.gov/encryption/aes/rijndael/Rijndael.pdf

http://csrc.nist.gov/publications/fips/fips197/fips-197.pdf

12.3 MD5

MD5C.C - RSA Data Security, Inc., MD5 message-digest algorithm

Copyright (C) 1991-2, RSA Data Security, Inc. Created 1991. All rights reserved.

License to copy and use this software is granted provided that it is identified as the "RSA Data Security, Inc. MD5 Message-Digest Algorithm" in all material mentioning or referencing this software or this function.

License is also granted to make and use derivative works provided that such works are identified as "derived from the RSA Data Security, Inc. MD5 Message-Digest Algorithm" in all material mentioning or referencing the derived work.

RSA Data Security, Inc. makes no representations concerning either the merchantability of this software or the suitability of this software for any particular purpose. It is provided "as is" without express or implied warranty of any kind.

These notices must be retained in any copies of any part of this documentation and/or software.

12.4 DHCP

Copyright (c) 2005, Swedish Institute of Computer Science

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the Institute nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE INSTITUTE AND CONTRIBUTORS ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE INSTITUTE OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

12.5 CMSIS DSP Software Library

Copyright (C) 2010 ARM Limited. All rights reserved.

12.6 Protothreads

Protothread class and macros for lightweight, stackless threads in C++.

This was "ported" to C++ from Adam Dunkels' protothreads C library at: http://www.sics.se/~adam/pt/

Originally ported for use by Hamilton Jet (www.hamiltonjet.co.nz) by Ben Hoyt, but stripped down for public release. See his blog entry about it for more information: http://blog.micropledge.com/2008/07/protothreads/

Original BSD-style license

Copyright (c) 2004-2005, Swedish Institute of Computer Science.

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the Institute nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

This software is provided by the Institute and contributors "as is" and any express or implied warranties, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose are disclaimed. In no event shall the Institute or contributors be liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, procurement of substitute goods or services; loss of use, data, or profits; or business interruption) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way out of the use of this software, even if advised of the possibility of such damage.

12.7 lwIP

Copyright (c) 2001-2004 Swedish Institute of Computer Science.

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. The name of the author may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE AUTHOR ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This file is part of the lwIP TCP/IP stack.

Author: Adam Dunkels <adam@sics.se>

12.8 littlefs

```
/*
* The little filesystem
*
* Copyright (c) 2017, Arm Limited. All rights reserved.
* SPDX-License-Identifier: BSD-3-Clause
*/
```

Copyright (c) 2017, Arm Limited. All rights reserved.

- Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:
- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of ARM nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.