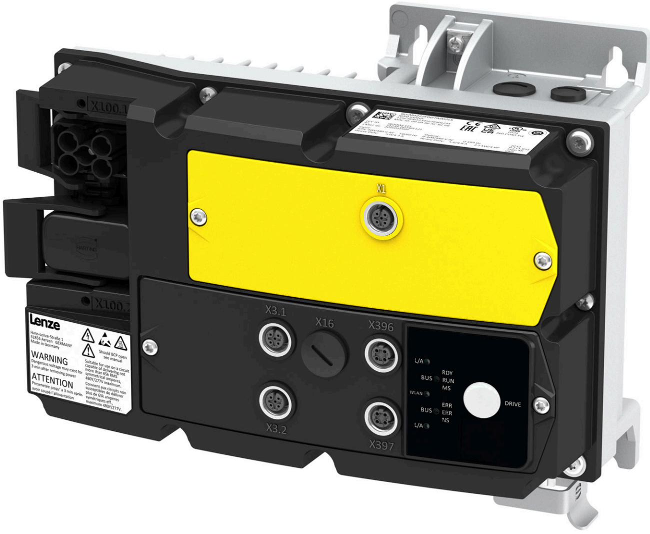
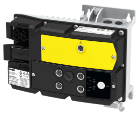
i550 motec frequency inverter



Contents



1 About this document

⚠WARNING!

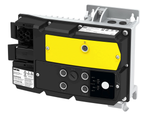
Read this documentation carefully before starting any work.

- Please observe the safety instructions!

1.1 Document description

This documentation is valid up to firmware version:

Firmware version	Software data version	Date
04.02.00.10	V0018	2023-05-05



1.2 Further documents

For certain tasks, information is available in further documents.

Document	Contents/topics
Mounting sheet	General safety instructions and important UL/CSA instructions, connection diagram and technical data. • The mounting sheet is included in the delivery of the product.
Operating instructions	Basic information on installing and commissioning the product.
Original operating instructions / project planning document	Basic information for project planning and for ordering the product. The document also contains information on mechanical and electrical installation, product extensions and accessories.

More information

For certain tasks, information is available in other media.

Medium	Contents/topics
Engineering Tools	For commissioning
AKB articles	Additional technical information for users in the Application Knowledge Base
CAD data	Download in different formats from the EASY Product Finder
EPLAN macros	Project planning, documentation and management of projects for EPLAN P8.
Device descriptions	Standardized files for network configuration

Information and tools with regard to the Lenze products can be found on the Internet:
www.lenze.com → Downloads

1.3 Notations and conventions

Conventions are used in this document to distinguish between different types of information.

Numeric notation		
Decimal separator	Point	Generally shown as a decimal point. Example: 1 234.56
Warnings		
UL Warnings	UL	Are used in English and French.
UR warnings	UR	
Text		
Engineering Tools	" "	Software Example: "EASY Starter", "PLC Designer"
Icons		
Page reference	🕮	Reference to another page with additional information. Example: 🕮 16 = see page 16
Documentation reference		Reference to other documentation with additional information. Example: EDKxxx = see documentation EDKxxx

Layout of the safety instructions

⚠ DANGER!

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

⚠ WARNING!

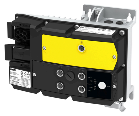
Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

⚠ CAUTION!

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTICE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.



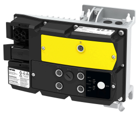
2 Safety instructions

2.1 Basic safety instructions

Disregarding the following basic safety instructions and safety information may lead to severe personal injury and damage to property!

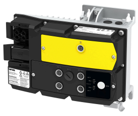
- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never modify the product technically.
- Never commission the product before assembly has been completed.
- Never operate the product without the required covers.
- Connect/disconnect all pluggable connections only in deenergized condition!
- Only remove the product from the installation in the deenergized state.
- The product can – depending on their degree of protection – have live, movable or rotating parts during or after operation. Surfaces can be hot.
- Observe the specifications of the corresponding documentation. This is the condition for safe and trouble-free operation and the achievement of the specified product features.
- The procedural notes and circuit details given in the associated documentation are suggestions and their transferability to the respective application has to be checked. The manufacturer of the product does not take responsibility for the suitability of the process and circuit proposals.
- All work with and on the product may only be carried out by qualified personnel. IEC 60364 and CENELEC HD 384 define the qualifications of these persons:
  - They are familiar with installing, mounting, commissioning, and operating the product.
  - They have the corresponding qualifications for their work.
  - They know and can apply all regulations for the prevention of accidents, directives, and laws applicable at the place of use.

Please observe the specific safety information in the other sections!



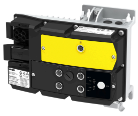
2.2 Application as directed

- The product is a professional equipment intended for use by trades, specific professions or industry and not for sale to the general public. IEC 60050 [IEV 161-05-05]
- To prevent personal injury and damage to property, higher-level safety and protection systems must be used!
- All transport locks must be removed.
- The product may only be operated under the specified operating conditions and in the specified mounting positions.
- The product is exclusively suitable for installation in control cabinets and, depending on the protection class and design, for wall and motor mounting.
- The product must only be actuated with motors that are suitable for the operation with inverters.
- The product must not be operated in private areas, in potentially explosive atmospheres and in areas with harmful gases, oils, acids and radiation.



2.3 Handling

The user is not allowed to change inverters that come with integrated functional safety. In the event of a defect, the inverter must be replaced.



2.4 Residual hazards

Even if notes given are taken into consideration and protective measures are implemented, the occurrence of residual risks cannot be fully prevented.

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this can lead to severe injuries to persons and damage to property!

Product

Observe the warning labels on the product!

Dangerous electrical voltage:
Before working on the product, make sure there is no voltage applied to the power terminals!
After mains disconnection, the power terminals will still carry the hazardous electrical voltage for the time given next to the symbol!

Electrostatic sensitive devices:
Before working on the product, the staff must ensure to be free of electrostatic charge!

High leakage current:
Carry out fixed installation and PE connection in compliance with:
EN 61800-5-1 / EN 60204-1

Hot surface:
Use personal protective equipment or wait until the device has cooled down!

Degree of protection - protection of persons and device protection

- Information applies to the mounted and ready-for-use state.

Device protection

- The maximum test voltage for insulation tests between a control potential of 48 V and PE must not exceed 110 V DC (EN 61800-5-1).

Motor protection

With some settings of the inverter, the connected motor can be overheated.

- E. g. by longer operation of self-ventilated motors at low speed.
- E. g. by longer operation of DC-injection braking.

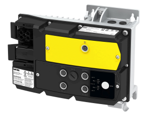
Protection of the machine/system

Drives can reach dangerous overspeeds.

- E. g. by setting high output frequencies in connection with motors and machines not suitable for this purpose.
- The inverters do not provide protection against such operating conditions. For this purpose, use additional components.

Motor

If there is a short circuit of two power transistors, a residual movement of up to 180°/number of pole pairs can occur at the motor! (e. g. 4-pole motor: residual movement max. 180°/2 = 90°).

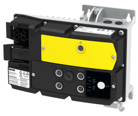


3 Product information

3.1 Identification of the products

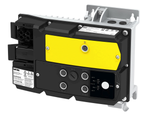
Order code structure

			I	5	5	A	M	□□□	□	□	□	□	□	□	0	□	□	S
Product type	Inverters		I															
Product family	i500			5														
Product	i550				5													
Product generation	Generation 1					A												
Mounting type	Motor and wall mounting						M											
Rated power	0.37 kW	0.5 hp						137										
	0.55 kW	0.75 hp						155										
	0.75 kW	1.0 hp						175										
	1.1 kW	1.5 hp						211										
	1.5 kW	2.0 hp						215										
	2.2 kW	3.0 hp						222										
	3.0 kW	4.0 hp						230										
	4.0 kW	5.5 hp						240										
	5.5 kW	7.5 hp						255										
	7.5 kW	10 hp						275										
	11 kW	15 hp						311										
	15 kW	20 hp						315										
	18.5 kW	25 hp						318										
	22 kW	30 hp						322										
	30 kW	40 hp						330										
	37 kW	50 hp						337										
	45 kW	60 hp						345										
Mains voltage and connection type	3/PE AC 230/240 V								C									
	3/PE AC 400 V 3/PE AC 480 V								F									
Extension box	Without extension box									0								
	With extension box	with mains connection terminals								1								
		with disconnect switch								A								
		with disconnect switch with status feedback								B								
		with Type E combination motor controller								C								
		with Type E combination motor controller with status feedback								D								
		with disconnect switch with status feedback and operating elements								E								
		with disconnect switch with status feedback, operating element and potentiometer								F								
Integrated functional safety	Without functional safety										0							
	Basic Safety - STO										A							
Degree of protection	IP54, coated	UL Type 12 / 12K										B						
	IP66, coated	UL Type 4X indoor										D						
Continuation ...																		



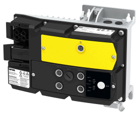
Order code structure (continuation)

			I	5	5	A	M	□□□	□	□	□	□	□	□	0	□	□	S
Motor connection	Without adapter												0					
	Wall adapter	with Han Q8											A					
		with fan and Han Q8											D					
		with M23											C					
		with fan and M23											F					
		with M40											H					
		with cable gland (M25)											B					
		with fan and cable gland (M25)											E					
		with cable gland (M40)											G					
	Motor adapter	for BG063 - BG071											I					
		for BG080 - BG112											J					
		for BG132											K					
		for BG160 - BG180											L					
Application area	Default setting of parameters: EU region (50-Hz systems)													0				
	Default setting of parameters: US region (60-Hz systems)													1				
Additional functions	Without														0			
Control connections	Standard I/O															0		
	Application I/O															1		
Network	EtherCAT																K	
	PROFINET																L	
	EtherNet/IP																M	
	Modbus TCP																W	



4 Commissioning

The purpose of commissioning is to adapt the inverter as part of a machine with a variable-speed drive system to its drive task.



4.1 Important notes

⚠ DANGER!

Incorrect wiring can cause unexpected states during the commissioning phase.

Possible consequences: death, severe injuries or damage to property

Ensure the following before switching on the mains voltage:

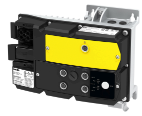
- Wiring must be complete and correct.
- Wiring must be free of short circuits and earth faults.
- The motor circuit configuration (star/delta) must be adapted to the inverter output voltage.
- The motor must be connected in-phase (direction of rotation).
- The "emergency switching off" function of the overall system must operate correctly.

⚠ DANGER!

Incorrect settings during commissioning may cause unexpected and dangerous motor and system movements.

Possible consequences: death, severe injuries or damage to property

- Clear hazardous area.
- Observe safety instructions and safety clearances.



4.2 Initial switch-on and functional test

Drive behaviour by default

By default, the V/f characteristic control with a linear characteristic is preset as motor control for asynchronous motors. The V/f characteristic control is a motor control for conventional frequency inverter applications. It is based on a simple and robust control mode for the operation of asynchronous motors with a linear or square-law load torque characteristic (e.g. fan). Because of the minimal parameterisation effort, such applications can be commissioned easily and quickly.

The default settings of the parameters ensure that the inverter is ready for operation immediately and the motor works adequately without further parameterisation if an inverter and an asynchronous motor* Hz asynchronous machine with matching performances are assigned to each other.

* Depending on the device/mains frequency either 50-Hz asynchronous motor or 60-Hz asynchronous motor.

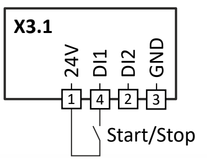
Functional test

Target: the motor connected to the inverter should rotate as quickly as possible.

Preconditions:

- The connected motor matches the inverter in terms of power.
- The parameter settings correspond to the state upon delivery.

1. **Preparation**
    1. Wire power connections. For details see operating instructions.
    2. Wire the connector X3.1 (digital input DI1):



2. **Switch on mains and check readiness for operation**
    1. Switch on mains voltage.
    2. Observe LED status displays “RDY” and “ERR” on the inverter front panel.
        a) If the blue "RDY" LED is blinking and the red "ERR" LED does not light up, the inverter is ready for operation. The controller is inhibited.
        You can now start the drive.
        b) If the red "ERR" LED is lit permanently, a fault is pending.
        Eliminate the fault before you carry on with the functional test.

Carry out functional test

1. If the inverter is equipped with an integrated safety system: X1/SIA = HIGH and X1/SIB = HIGH.
2. Start drive: X3.1/DI1 = HIGH (close "Start/Stop" switch).
    The drive rotates with 20 Hz.
3. Stop drive again: X3.1/DI1 = LOW (open "Start/Stop" switch).

The functional test has been completed.

Related topics

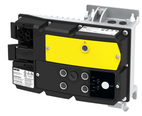
▶ Function assignment of the digital inputs (default) 📖 43
▶ LED status display 📖 430
▶ Error codes, causes and remedies 📖 448

4.3 Operating interfaces

Wired communication with the inverter can take place via the X16 diagnostic interface (USB interface) or via network (EtherCAT, EtherNet/IP or PROFINET).

Diagnostic interface X16 (USB interface)

- A standard USB cable with USB-C connector is required for communication.
- The USB port may only be used temporarily for the diagnostics and parameterization of the inverter. We recommend keeping the inverter and diagnostics device on the same ground potential or disconnecting the diagnostics device from the mains.
- Parameterizing without motor operation does not require a mains voltage. If you connect the inverter directly to the PC without a hub, the USB interface of the PC is sufficient for the voltage supply.

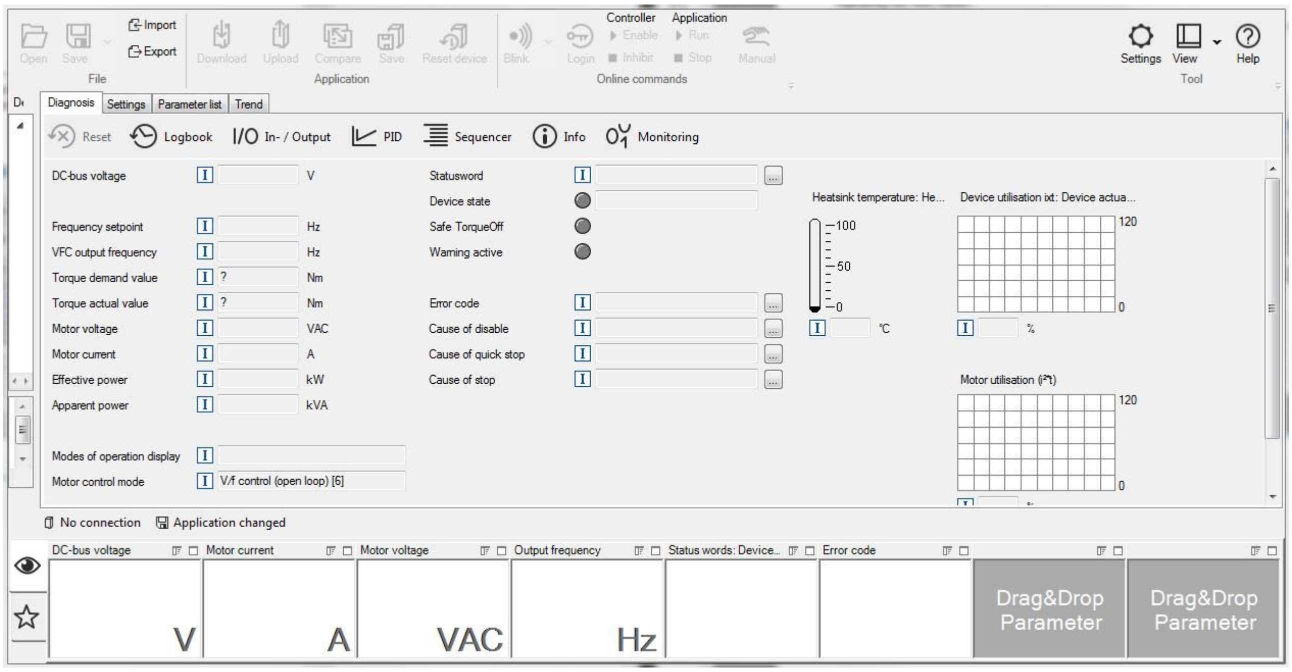


Engineering Tool »EASY Starter«

Commissioning and diagnostics are performed via the "EASY Starter" engineering tool.

Download »EASY Starter«: EASY Engineering Tools Downloads

Screenshot:



Establish connection between inverter and »EASY Starter«

Preconditions for commissioning:

- The functional test has been completed successfully (without any errors or faults).
  ▶ Initial switch-on and functional test 📖 24
- The inverter is ready for operation. The mains voltage is switched on.

Accessories required for commissioning:

- USB cable wit USB-C connector
- PC with installed »EASY Starter« software

1. Insert the USB-C plug of the USB cable into the USB socket of the inverter.
2. Plug the other end into a free USB socket on the PC.
3. Start »EASY Starter«.
   The "Add devices" dialog is shown.
4. Select the "USB on Board" connection.
5. Click the **Insert** button.

»EASY Starter« searches for connected devices via the communication path selected. When the connection has been established successfully, the inverter is displayed in the device list of »EASY Starter«. The inverter parameters can now be accessed via the tabs of »EASY Starter«.

4.4 General information on parameter setting

Being a component of a machine which includes a speed-variable system, the inverter needs to be adapted to its drive task. The inverter is adjusted by changing parameters.

The parameters can be accessed via the operating interfaces on the inverter. ▶ Operating interfaces 📖 25

If the inverter is equipped with a network option, access from a higher-level controller via the network is also possible.

Certain device commands or settings which might cause a critical state of the drive behavior can only be carried out when the device is disabled.

4.4.1 Addressing of the parameters

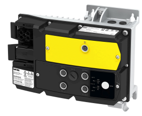
Each parameter features a 16-bit index as its address. Under this address, the parameter is stored in the object directory of the device.

- Parameters that belong together functionally are combined in a data set. These parameters are additionally provided with an 8-bit subindex.
- The colon is used as a separator between the index and subindex Example: "0x2540:001"
- There are parameter settings that can be changed, and (diagnostic) parameters that can only be read.

The following conventions are used in this documentation for specifying the parameter address:

• The index is specified as a hexadecimal value.

• The subindex is specified as a decimal value.



4.4.2 Structure of the parameter descriptions

- The parameter descriptions in this documentation are structured in table form.
- The representation distinguishes parameters with a setting range, text, selection list, and bit-coded display.
- The default setting of parameters with a write access feature is shown in **bold**.

Example: parameters with a setting range

Address	Name / setting range / [default setting]	Information
Index:Subindex	Parameter designation Minimum value ... [**default setting**] ... maximum value • Optional information with regard to the parameter.	Explanations & notes with regard to the parameter.

Example: parameters with a selection list

Address	Name / setting range / [default setting]		Information
Index:Subindex	Parameter designation • Optional information with regard to the parameter.		Explanations & notes with regard to the parameter. **Note:** The corresponding selection number (here 0, 1, or 2) must be set. Other values are not permissible.
	0	**Designation of selection 0**	Optionally: Explanations & notes with regard to the corresponding selection. The default selection is shown in **bold**.
	1	Designation of selection 1	
	2	Designation of selection 2	

Example with bit coded display

Address	Name / setting range / [default setting]		Information
Index:Subindex	Parameter designation • Optional information with regard to the parameter.		Explanations & notes with regard to the parameter.
	Bit 0	Designation of bit 0	Optionally: Explanations & notes with regard to the corresponding bit.
	Bit 1	Designation of bit 1	
	Bit 2	Designation of bit 2	
	...	...	
	Bit 15	Designation of bit 15	

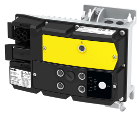
4.4.3 Parameter overview lists

Parameter attribute list: contains a list of all inverter parameters. This list in particular includes some information that is relevant for the reading and writing of parameters via the network.
465

4.4.4 Favorites

In order to gain quick access using the »EASY Starter«, frequently used parameters of the inverter can be defined as "Favorites".

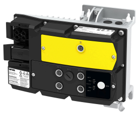
- »EASY Starter« provides quick access to the "Favorites" via the *Favorites* tab.



4.4.4.1 Favorites parameter list (default setting)

In the default setting, parameters for resolving typical applications are defined as "Favorites”.

No.	Address	Name	Default setting	Setting range
1	0x2DDD	Output frequency	x.x Hz	- (Read only)
2	0x6078	Actual current	x.x %	- (Read only)
3	0x2D89	Motor voltage	x VAC	- (Read only)
4	0x603F	Error code	-	- (Read only)
5	- (not assigned)	-	-	-
6	0x2860:001	Frequency control: Default setpoint source	**Frequency preset 1 [11]**	Selection list
7	0x2838:001	Start method	**Normal [0]**	Selection list
8	0x2838:003	Stop method	**Standard ramp [1]**	Selection list
9	0x2540:001	Rated mains voltage	**230 Veff [0]**	Selection list
10	0x2915	Minimum frequency	**0.0 Hz**	0.0 ... 599.0 Hz
11	0x2916	Maximum frequency	**50.0 Hz**	0.0 ... 599.0 Hz
12	0x291D:001	Acceleration time 1	**5.00 s**	0.00 ... 655.35 s
13	0x291D:002	Deceleration time 1	**5.00 s**	0.00 ... 655.35 s
14	0x2C00	Motor control mode	**V/f characteristic control (VFC open loop) [6]**	Selection list
15	0x2B00	V/f characteristic shape	**Linear [0]**	Selection list
16	0x2B01:001	Base voltage	**400 V**	0 ... 5000 V
17	0x2B01:002	Base frequency	**50 Hz**	0 ... 1500 Hz
18	0x283A	Limitation of rotation	**Both rotational directions [1]**	Selection list
19	0x2939	Switching frequency	**0**	1 ... 33
20	0x2D4B:001	Maximum utilisation [60 s]	**150 %**	30 ... 400 %
21	0x2B12:001	Fixed boost	**2.5 %**	0.0 ... 20.0 %
22	0x6075	Rated motor current	**1.420 A**	0.001 ... 500.000 A
23	0x6073	Max. current	**200.0 %**	0.0 ... 3000.0 %
24	0x2631:001	Enable inverter	**Constant TRUE [1]**	Trigger list 58
25	0x2631:002	Run	**Digital input 1 [11]**	Trigger list 58
26	0x2631:003	Activate quick stop	**Not connected [0]**	Trigger list 58
27	0x2631:004	Reset fault	**Digital input 2 [12]**	Trigger list 58
28	0x2631:005	Activate DC braking	**Not connected [0]**	Trigger list 58
29	0x2631:006	Start forward (CW)	**Not connected [0]**	Trigger list 58
30	0x2631:007	Start reverse (CCW)	**Not connected [0]**	Trigger list 58
31	0x2631:008	Run forward (CW)	**Not connected [0]**	Trigger list 58
32	0x2631:009	Run reverse (CCW)	**Not connected [0]**	Trigger list 58
33	0x2631:013	Reverse rotational direction	**Digital input 3 [13]**	Trigger list 58
34	0x2631:018	Activate preset (bit 0)	**Digital input 4 [14]**	Trigger list 58
35	0x2631:019	Activate preset (bit 1)	**Not connected [0]**	Trigger list 58
36	0x2631:020	Activate preset (bit 2)	**Not connected [0]**	Trigger list 58
37	- (not assigned)	-	-	-
38	0x2634:002	Digital output 1	**Operation enabled [52]**	Selection list
39	- (not assigned)	-	-	-
40	- (not assigned)	-	-	-
41	- (not assigned)	-	-	-
42	- (not assigned)	-	-	-
43	- (not assigned)	-	-	-
44	- (not assigned)	-	-	-
45	- (not assigned)	-	-	-
46	0x2911:001	Preset 1	**20.0 Hz**	0.0 ... 1000.0 Hz
47	0x2911:002	Preset 2	**40.0 Hz**	0.0 ... 1000.0 Hz
48	0x2911:003	Preset 3	**50.0 Hz**	0.0 ... 1000.0 Hz
49	0x2911:004	Preset 4	**0.0 Hz**	0.0 ... 1000.0 Hz
50	- (not assigned)	-	-	-



4.4.4.2 Configuring the "Favorites"

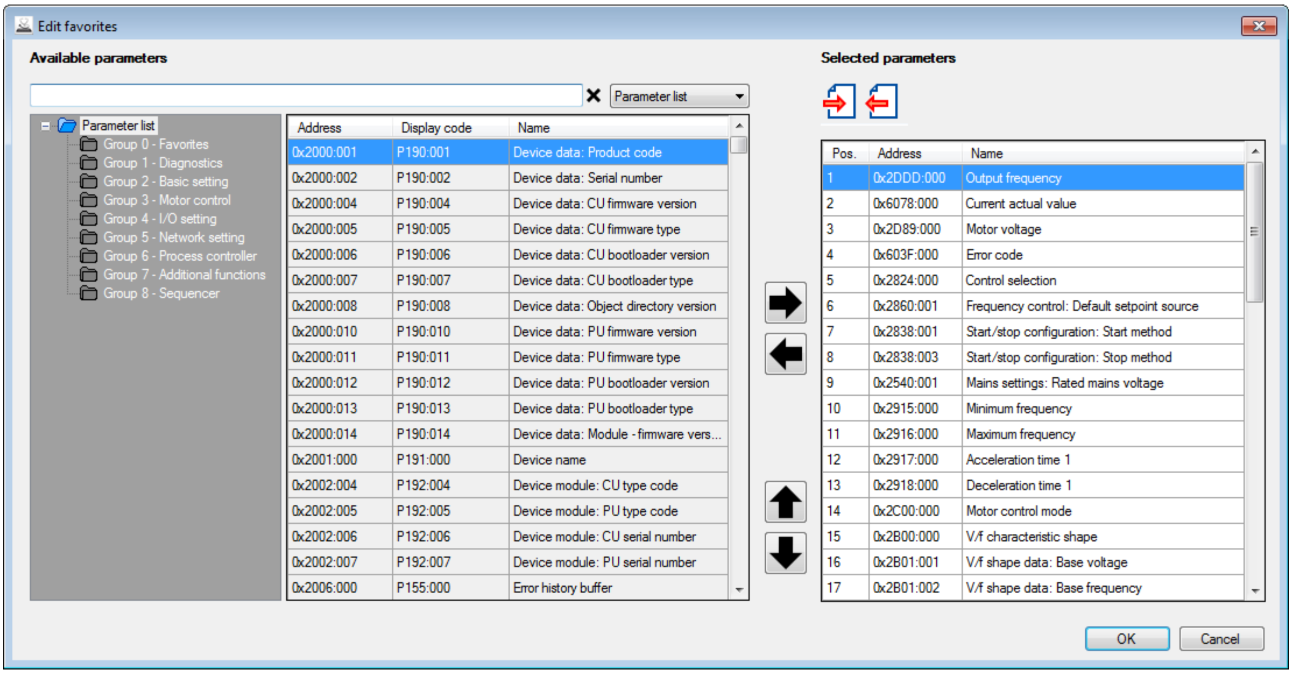
The "Favorites" can be configured by the user.

Details

A maximum number of 50 parameters can be defined as "Favorites".

The easiest way to process the selection of the favorites is via the parameterisation dialog in the »EASY Starter«:

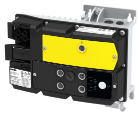
1. Change to the "Parameter list" tab.
2. Select group 0 - Favorites.
3. Click the button.
4. Process favorites:



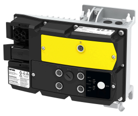
Default favorites can be changed via network using the following parameters:

Parameter

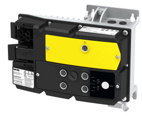
Address	Name / setting range / [default setting]	Information
0x261C:001	Favorites settings: Parameter 1 0 ... **[769458176]** ... 4294967040	Definition of the "Favorites" parameters. • Format: 0xiiiiss00 (iiii = hexadecimal index, ss = hexadecimal subindex) • The lowest byte is always 0x00.
0x261C:002	Favorites settings: Parameter 2 0 ... **[1618477056]** ... 4294967040	
0x261C:003	Favorites settings: Parameter 3 0 ... **[763953152]** ... 4294967040	
0x261C:004	Favorites settings: Parameter 4 0 ... **[1614741504]** ... 4294967040	
0x261C:005	Favorites settings: Parameter 5 0 ... **[673447936]** ... 4294967040	
0x261C:006	Favorites settings: Parameter 6 0 ... **[677380352]** ... 4294967040	
0x261C:007	Favorites settings: Parameter 7 0 ... **[674758912]** ... 4294967040	
0x261C:008	Favorites settings: Parameter 8 0 ... **[674759424]** ... 4294967040	
0x261C:009	Favorites settings: Parameter 9 0 ... **[624951552]** ... 4294967040	
0x261C:010	Favorites settings: Parameter 10 0 ... **[689242112]** ... 4294967040	



Address	Name / setting range / [default setting]	Information
0x261C:011	Favorites settings: Parameter 11 0 ... [**689307648**] ... 4294967040	
0x261C:012	Favorites settings: Parameter 12 0 ... [**689766656**] ... 4294967040	
0x261C:013	Favorites settings: Parameter 13 0 ... [**689766912**] ... 4294967040	
0x261C:014	Favorites settings: Parameter 14 0 ... [**738197504**] ... 4294967040	
0x261C:015	Favorites settings: Parameter 15 0 ... [**721420288**] ... 4294967040	
0x261C:016	Favorites settings: Parameter 16 0 ... [**721486080**] ... 4294967040	
0x261C:017	Favorites settings: Parameter 17 0 ... [**721486336**] ... 4294967040	
0x261C:018	Favorites settings: Parameter 18 0 ... [**674889728**] ... 4294967040	
0x261C:019	Favorites settings: Parameter 19 0 ... [**691601408**] ... 4294967040	
0x261C:020	Favorites settings: Parameter 20 0 ... [**759890176**] ... 4294967040	
0x261C:021	Favorites settings: Parameter 21 0 ... [**722600192**] ... 4294967040	
0x261C:022	Favorites settings: Parameter 22 0 ... [**1618280448**] ... 4294967040	
0x261C:023	Favorites settings: Parameter 23 0 ... [**1618149376**] ... 4294967040	
0x261C:024	Favorites settings: Parameter 24 0 ... [**640745728**] ... 4294967040	
0x261C:025	Favorites settings: Parameter 25 0 ... [**640745984**] ... 4294967040	
0x261C:026	Favorites settings: Parameter 26 0 ... [**640746240**] ... 4294967040	
0x261C:027	Favorites settings: Parameter 27 0 ... [**640746496**] ... 4294967040	
0x261C:028	Favorites settings: Parameter 28 0 ... [**640746752**] ... 4294967040	
0x261C:029	Favorites settings: Parameter 29 0 ... [**640747008**] ... 4294967040	
0x261C:030	Favorites settings: Parameter 30 0 ... [**640747264**] ... 4294967040	
0x261C:031	Favorites settings: Parameter 31 0 ... [**640747520**] ... 4294967040	
0x261C:032	Favorites settings: Parameter 32 0 ... [**640747776**] ... 4294967040	
0x261C:033	Favorites settings: Parameter 33 0 ... [**640748800**] ... 4294967040	
0x261C:034	Favorites settings: Parameter 34 0 ... [**640750080**] ... 4294967040	
0x261C:035	Favorites settings: Parameter 35 0 ... [**640750336**] ... 4294967040	
0x261C:036	Favorites settings: Parameter 36 0 ... [**640750592**] ... 4294967040	
0x261C:037	Favorites settings: Parameter 37 0 ... [**640942336**] ... 4294967040	
0x261C:038	Favorites settings: Parameter 38 0 ... [**640942592**] ... 4294967040	
0x261C:039	Favorites settings: Parameter 39 0 ... [**641073408**] ... 4294967040	
0x261C:040	Favorites settings: Parameter 40 0 ... [**641073664**] ... 4294967040	



Address	Name / setting range / [default setting]	Information
0x261C:041	Favorites settings: Parameter 41 0 ... [**641073920**] ... 4294967040	
0x261C:042	Favorites settings: Parameter 42 0 ... [**641270016**] ... 4294967040	
0x261C:043	Favorites settings: Parameter 43 0 ... [**641270272**] ... 4294967040	
0x261C:044	Favorites settings: Parameter 44 0 ... [**641270528**] ... 4294967040	
0x261C:045	Favorites settings: Parameter 45 0 ... [**641270784**] ... 4294967040	
0x261C:046	Favorites settings: Parameter 46 0 ... [**688980224**] ... 4294967040	
0x261C:047	Favorites settings: Parameter 47 0 ... [**688980480**] ... 4294967040	
0x261C:048	Favorites settings: Parameter 48 0 ... [**688980736**] ... 4294967040	
0x261C:049	Favorites settings: Parameter 49 0 ... [**688980992**] ... 4294967040	
0x261C:050	Favorites settings: Parameter 50 0 ... [**0**] ... 4294967040	



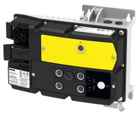
4.5 Saving the parameter settings

4.5.1 Save parameter settings with »EASY Starter«

If a parameter setting has been changed with the »EASY Starter« but not yet saved in the memory medium with mains failure protection, the status line of the »EASY Starter« displays the note "The parameter set was changed".

There are 3 options to save the parameter settings in the user memory of the storage medium

- Click the button in the toolbar of the »EASY Starter« .
- Press the function key **F6**.
- Execute the device command "Save user data": 0x2022:003 = "On / start [1]".

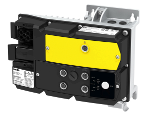


5 Basic setting

5.1 Device name

Parameter

Address	Name / setting range / [default setting]	Information
0x2001	Device name ["**My Device**"]	Any device name can be set in this object for the purpose of device identification.



5.2 Mains voltage

The rated mains voltage set for the inverter has an impact on the operating range of the inverter.

Details

By default, the rated mains voltage in 0x2540:001 is set according to the product code of the inverter.

Check the setting of the rated mains voltage in 0x2540:001. Ensure that it matches the mains voltage applied!

Region	Inverters	Product code 0x2000:001	Rated mains voltage	
			Default setting	Possible settings
EU	i550 motec, 230 V, 3-phase	I55xxxxxCxxxx0xxxx	230 Veff [0]	230 Veff [0]
US	i550 motec, 230 V, 3-phase	I55xxxxxCxxxx1xxxx	230 Veff [0]	230 Veff [0]
EU	i550 motec, 400 V, 3-phase	I55xxxxxFxxxx0xxxx	400 Veff [1]	400 Veff [1], 480 Veff [2]
US	i550 motec, 480 V, 3-phase	I55xxxxxFxxxx1xxxx	480 Veff [2]	400 Veff [1], 480 Veff [2]

Notes regarding the table:

- The inverter types 400/480 V can be used with different mains voltages. For establishing the internal limit values, the rated mains voltage can be set in 0x2540:001.
- If the inverter is reset to the delivery state, the rated mains voltage is also reset to the default setting (see table).

The following results from the rated mains voltage set:

- the error threshold for monitoring the DC-bus voltage and
- the calculation basis for motor overload monitoring (i2xt).

Monitoring of the DC-bus voltage

- The warning thresholds for monitoring are adjustable.
- The error thresholds and reset thresholds for monitoring result from the rated mains voltage set:

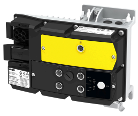
Rated mains voltage	Undervoltage thresholds			Overvoltage thresholds		
	Warning threshold	Error threshold	Reset threshold	Warning threshold	Error threshold	Reset threshold
Setting in 0x2540:001	Setting in 0x2540:002	Display in 0x2540:003	Display in 0x2540:004	Setting in 0x2540:005	Display in 0x2540:006	Display in 0x2540:007

- If the DC-bus voltage of the inverter falls below the undervoltage error threshold, the "Trouble" response is triggered.
  - Without external voltage supply DC 24 ... 48 V: The motor behaves according to 0x2838:002.
  - With external voltage supply DC 24 ... 48 V: The motor behaves according to the fault behavior in case of undervoltage.
- If the DC-bus voltage of the inverter exceeds the error threshold for overvoltage, the "Error" response occurs.

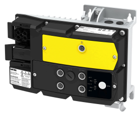
The motor does not restart automatically after the overvoltage monitoring function has been triggered.

Parameter

Address	Name / setting range / [default setting]		Information
0x2540:001	Mains settings: Rated mains voltage • Setting can only be changed if the inverter is disabled.		Selection of the mains voltage for actuating the inverter.
	0	**230 Veff**	
	1	400 Veff	
	2	480 Veff	



Address	Name / setting range / [default setting]	Information
0x2540:002	Mains settings: Undervoltage warning threshold 0 ... [**0**] ... 800 V	Monitoring for undervoltage (LU) in the DC bus: Setting of the warning threshold. • If the DC voltage in the DC bus falls below the threshold set, the inverter outputs a warning. • The warning is reset with a hysteresis of 10 V.
0x2540:003	Mains settings: Undervoltage error threshold • Read only: x V	Monitoring for undervoltage (LU) in the DC bus: Display of the fixed threshold. • If the DC voltage in the DC bus falls below the threshold displayed, the error"" response is triggered.
0x2540:004	Mains settings: Undervoltage reset threshold • Read only: x V	Display of the fixed reset threshold for monitoring DC bus undervoltage.
0x2540:005	Mains settings: Overvoltage warning threshold 0 ... [**0**] ... 800 V	Monitoring for overvoltage (OU) in the DC bus: Setting of the warning threshold. • If the DC bus voltage exceeds the threshold set, the inverter outputs a warning. • The warning is reset with a hysteresis of 10 V.
0x2540:006	Mains settings: Overvoltage error threshold • Read only: x V	Monitoring for overvoltage (OU) in the DC bus: Display of the fixed threshold. • If the DC-bus voltage exceeds the threshold displayed, the "Fault" response is triggered.
0x2540:007	Mains settings: Overvoltage reset threshold • Read only: x V	Display of the fixed reset threshold for monitoring DC bus overvoltage.



5.3 Frequency limits

The frequency range can be limited by setting a minimum and maximum frequency.

Parameter

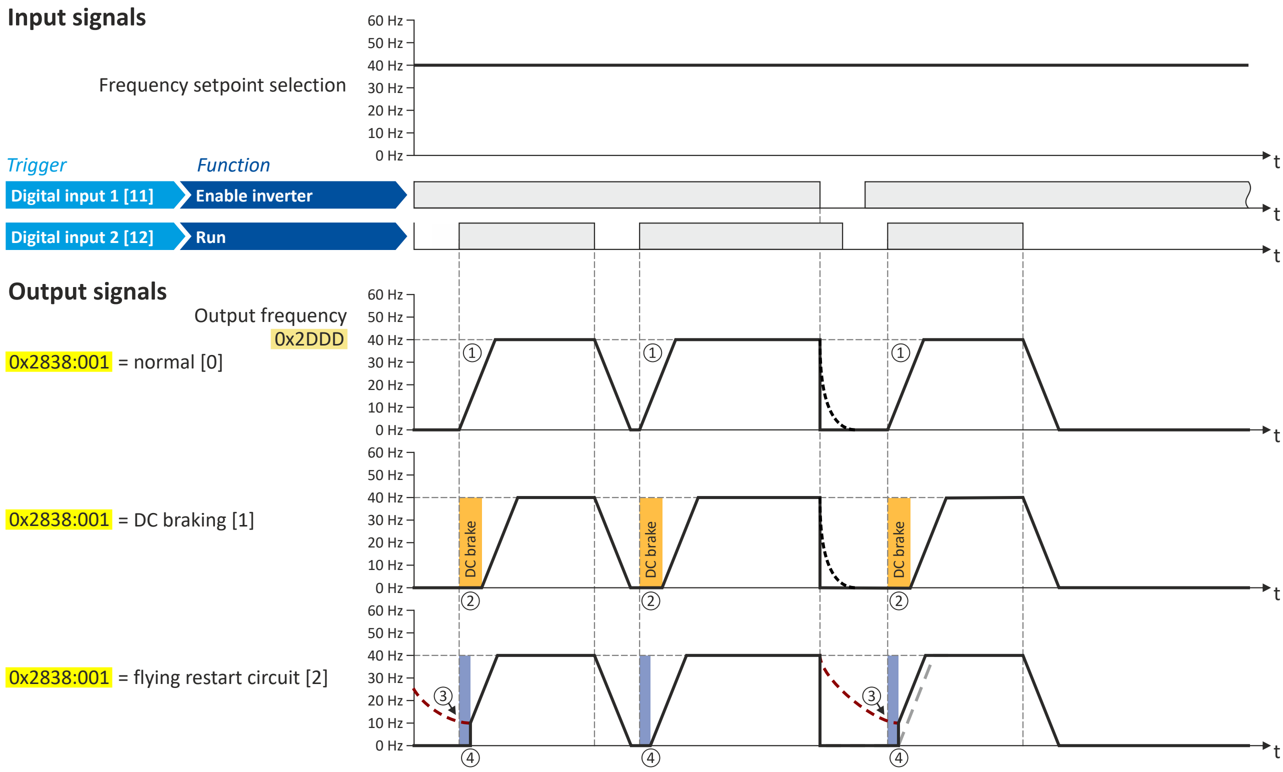
Address	Name / setting range / [default setting]	Information
0x2915	Minimum frequency 0.0 ... [**0.0**] ... 599.0 Hz	Lower limit value for all frequency setpoints.
0x2916	Maximum frequency 0.0 ... [**50.0**] ... 599.0 Hz	Upper limit value for all frequency setpoints.

5.4 Start behavior

The start can be optionally made with DC braking or flying restart circuit. Moreover, an automatic start can be activated after switch-on.

Details

The start method can be selected in 0x2838:001. The following diagram demonstrates the different start methods:

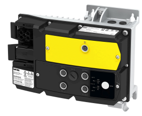


① Start method = "Normal [0]": After the start command, the motor is accelerated to the setpoint with the set acceleration time.

② Start method = "DC braking [1]": After the start command, the "DC braking" function is active. Only after the hold time set in 0x2B84:002 has elapsed is the motor accelerated to the setpoint with the set acceleration time.
▶ DC braking 📖 145

③ For demonstrating the flying restart circuit: At the time of the start command, the motor is not at standstill (for instance due to loads with high inertia such as fans or flywheels).

④ Start method = "Flying restart circuit [2]": After the start command, the "DC braking" flying restart circuit is active. The flying restart function makes it possible to restart a coasting motor during operation without speed feedback. Synchronicity between the inverter and motor is coordinated so that the transition to the rotating motor is effected without jerk at the time of connection.
▶ Flying restart circuit 📖 133



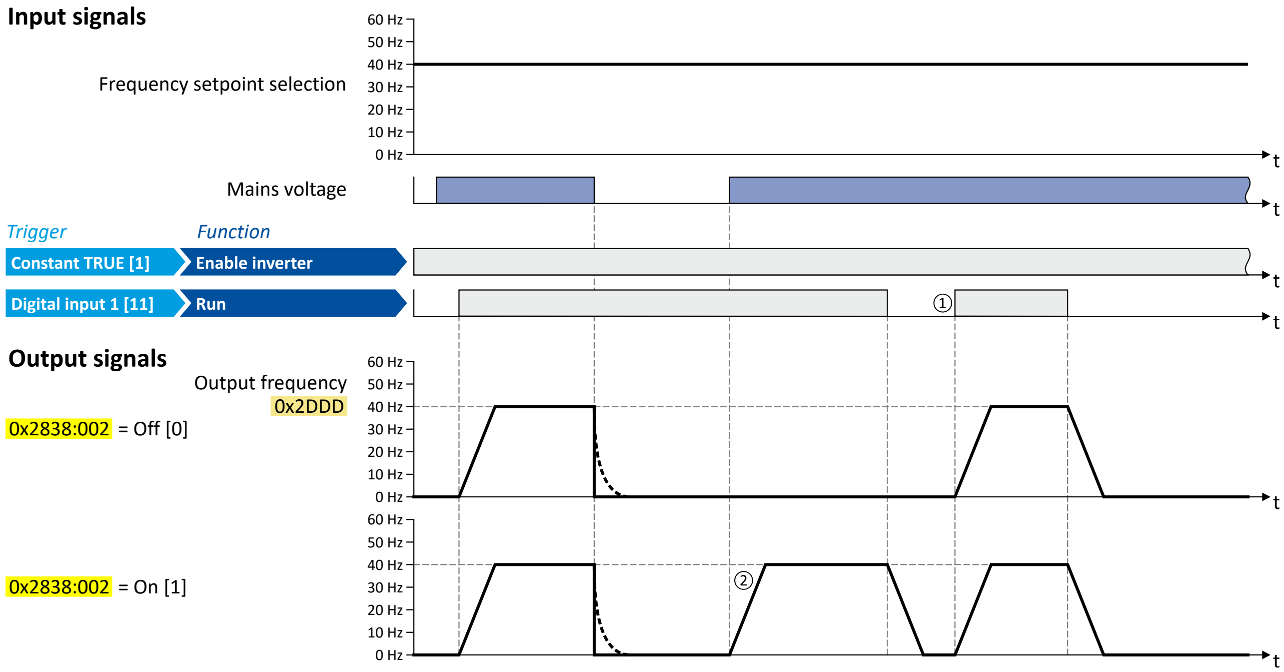
Automatic start after switching on the mains voltage

The automatic start can be activated in 0x2838:002.

Preconditions for the automatic start:

- For the start command, a digital input has been configured. (In case of activated network control, an automatic start is not possible.)

The following diagram demonstrates the function:



① Start at power-up = "Off [0]": After switching on the mains voltage, a renewed start command is required to start the motor.

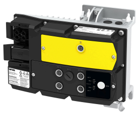
② Start at power-up = "On [1]": After switching on the mains voltage, the motor starts automatically if a start command is present.

Parameter

Address	Name / setting range / [default setting]		Information
0x2838:001	Start/stop configuration: Start method		Response after starting command.
	0	**Normal**	After start command, the standard ramps are active. • Acceleration time 1 can be set in 0x291D:001. • Deceleration time 1 can be set in 0x291D:002.
	1	DC braking	After start command, the "DC braking" function is active for the time set in 0x2B84:002. ▸ DC braking 145 ⚠ CAUTION! Deactivate automatic DC braking, if a holding brake is used.
	2	Flying restart circuit	After the start command, the flying restart circuit is active. The flying restart function makes it possible to restart a coasting motor during operation without speed feedback. The course between the inverter and motor is coordinated so that the transition to the rotating motor is effected without jerk at the time of connection. ▸ Flying restart circuit 133
0x2838:002	Start/stop configuration: Start at power-up		Start behavior after switching on the mains voltage.
	0	**Off**	No automatic start after switching on mains voltage. In addition to the inverter enable, a renewed start command is always required to start the motor.
	1	On	Automatic start of the motor after switching on the mains voltage if the inverter is enabled and a start command exists.

Related topics

▸ Start, stop and rotating direction commands 51

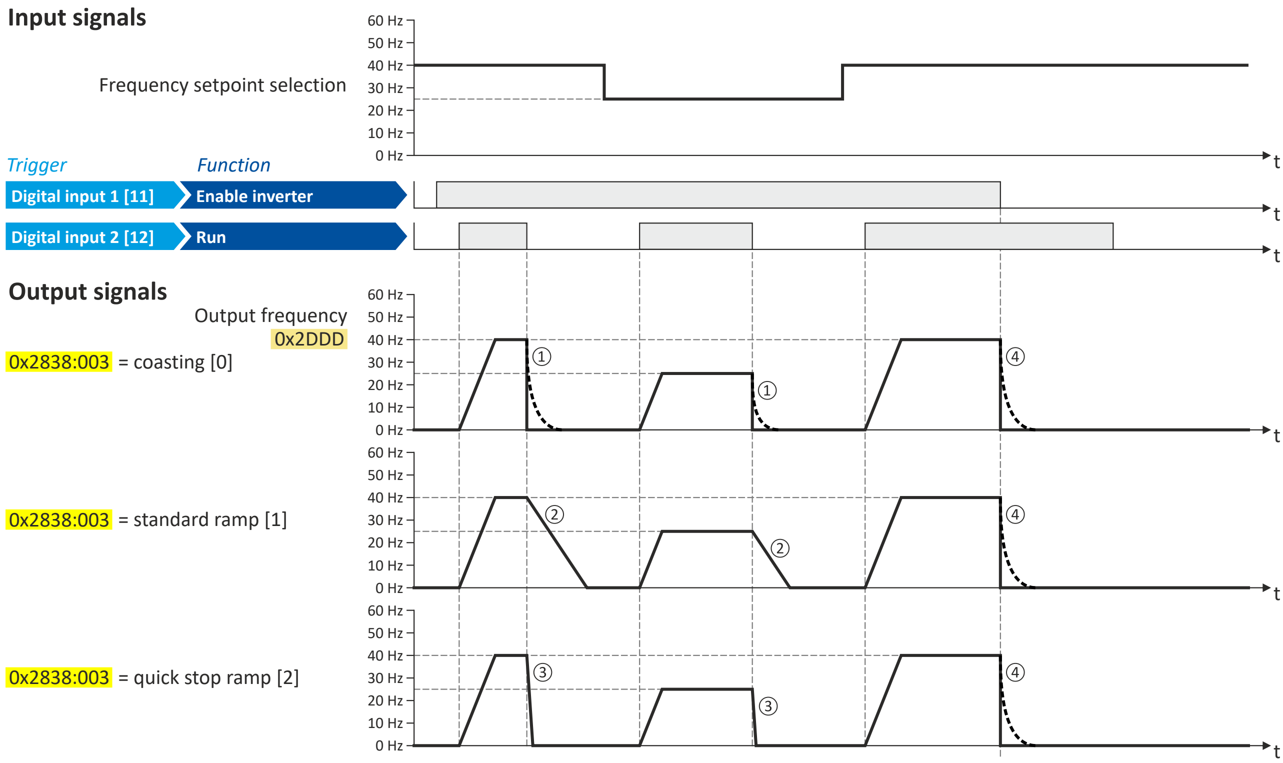


5.5 Stop behavior

In the default setting, the motor is brought to a standstill after a stop command with standard ramp. Alternatively, coasting, ramping down with quick stop ramp or a switch-off positioning can be selected.

Details

The stop method can be selected in 0x2838:003. The following diagram demonstrates the different stop methods:



① Stop method = "Coasting [0]": The motor coasts down.

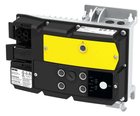
② Stop method = "Standard ramp [1]": The motor is brought to standstill with a deceleration time 1 (here: 10 s).

③ Stop method = "Quick stop ramp [2]": The motor is brought to a standstill with the deceleration time for quick stop (here: 1 s).

④ If "Enable inverter" is set to FALSE, the inverter is disabled. The motor has no torque and coasts to standstill depending on the mass inertia of the machine (irrespective of the set stop method).

Parameter

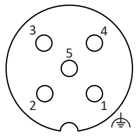
Address	Name / setting range / [default setting]		Information
0x2838:003	Start/stop configuration: Stop method		Response after stop command.
	0	Coasting	The motor has no torque (coasts down to standstill).
	1	**Standard ramp**	The motor is brought to a standstill with deceleration time 1 (or deceleration time 2, if activated). • Deceleration time 1 can be set in 0x291D:002. • Deceleration time 2 can be set in 0x291D:004. ▸ Ramp times 📖 76
	2	Quick stop ramp	The motor is brought to a standstill with the deceleration time set for the "Quick stop" function. • Deceleration time for quick stop can be set in 0x291C. • The "quick stop" function can also be activated manually, for instance via a digital input. ▸ Flexible I/O configuration of the start, stop and rotating direction commands 📖 52



5.6 Control connections

By default, all control connections are configured as digital inputs.

Connectors X3.3 and X3.4 are only available on the inverter with application I/O.

M12 connectors (A coded)	Pin	Assignment (delivery status)			
		X3.1	X3.2	X3.3	X3.4
	1	24 V			
	2	DI2	DI4	DI6	DI8
	3	GND			
	4	DI1	DI3	DI5	DI7
	5	not assigned			
	⏚	Housing is connected to functional earth			

Recommended procedure:

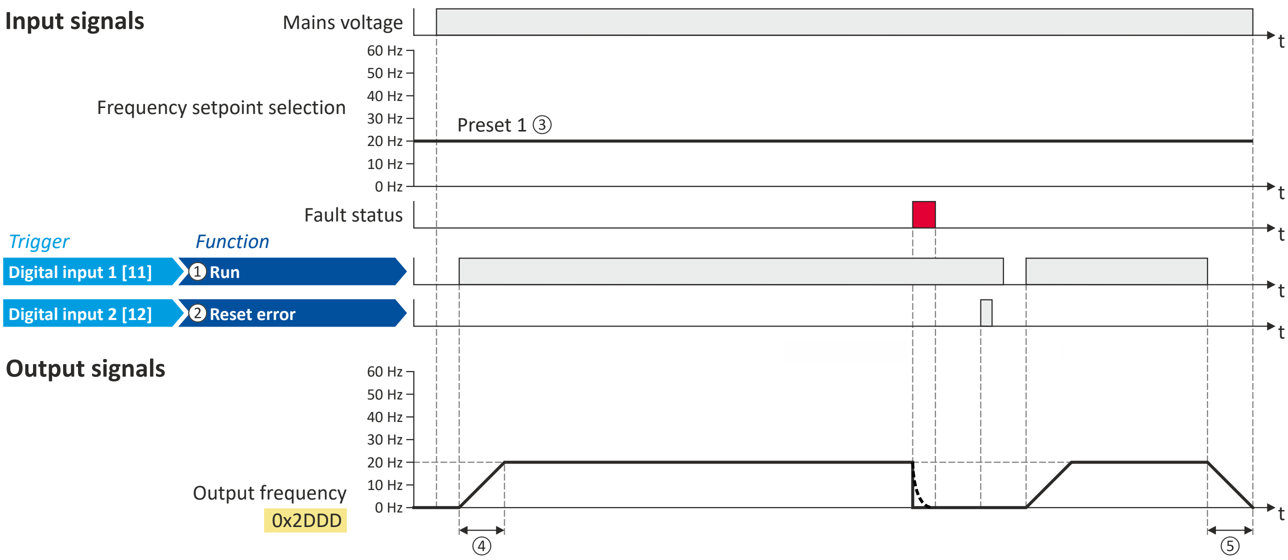
1. First configure the basic functionality of the control connections (digital input, digital output, encoder inputs, etc.).
   - The »EASY Starter« supports you in this via corresponding dialogs.
2. Then use the "Flexible I/O configuration" to adapt the control of the inverter to the drive task.
   - Digital input signals can be assigned to control functions of the inverter.
   - Status signals of the inverter can be assigned to digital output signals.

All functional setting options for the control ports are described in chapter "I/O extensions and control connections". 🕮 188

5.7 Function assignment of the digital inputs (default)

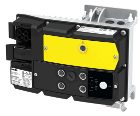
By default, the digital inputs are assigned the following control functions:

- The inverter can be started via digital input 1.
- A resettable error can be reset via digital input 2 (provided the error condition is no longer present).
- No functions are assigned to all other digital inputs.



Parameter		Name	Default setting
Control functions			
①	0x2631:002	Run	Digital input 1 [11]
②	0x2631:004	Reset fault	Digital input 2 [12]
Settings for the frequency setpoint			
③	0x2860:001	Frequency control: Default setpoint source	Frequency preset 1 [11]
	0x2911:001	Frequency setpoint presets: Preset 1	20 Hz
④	0x291D:001	Acceleration time 1	5.00 s
⑤	0x291D:002	Deceleration time 1	5.00 s

All functional possible settings for controlling the inverter are described in the "Start, stop and rotating direction commands" chapter. 📖 51



5.8 Inverter with extension box

Inverters with extension box

For the product variants "B", "E" and "F", the control connection X3.1 serves as an interface to the control elements of the extension box. When configuring the inverter with the "EASY Starter", a suitable functionality of the control connections is automatically set for these versions.

"Extension box with disconnect switch" option

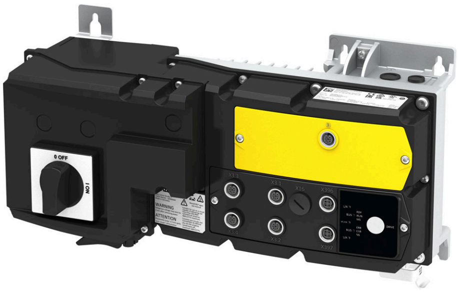


Fig. 1: Example for i550 motec with "Extension Box with disconnect switch" option

Operating element	Function	Details
Disconnect switch	Mains voltage on/off	Position "I ON" = mains voltage On Position "0 OFF" = mains voltage Off

"Extension box with disconnect switch with status feedback" option

Communication with the extension box takes place via X3.1 (for standard I/O) or X3.3 (for application I/O).

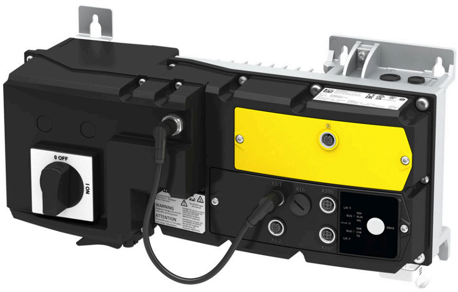
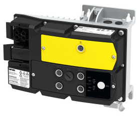


Fig. 2: Example for i550 motec with "Extension box with disconnect switch with status feedback" option

Operating element	Function	Details
Disconnect switch	Mains voltage on/off	Position "I ON" = mains voltage On Position "0 OFF" = mains voltage Off Status feedback via DI2 (for standard I/O) or DI6 (for application I/O)



“Extension box with disconnect switch with status feedback and operating elements” option

Communication with the extension box takes place via X3.3 using IO-Link.

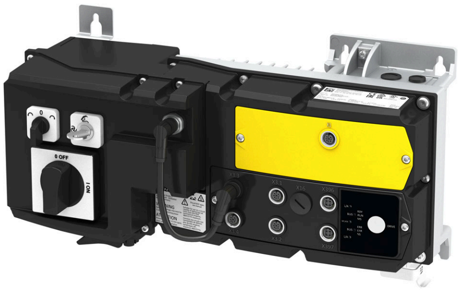


Fig. 3: Example for i550 motec with "Extension box with disconnect switch with status feedback and operating elements” option

Operating element	Function	Details
Disconnect switch	Mains voltage on/off	Position "I ON" = mains voltage On Position "0 OFF" = mains voltage Off Status feedback can be configured in the »EASY Starter«.
Operating element 1	Forward/Reverse/Stop	Right position = let motor rotate forward (CW) with frequency preset 1 Left position = let motor rotate reverse (CCW) with frequency preset 1 Position "0" = stop motor Frequency preset 1 (default: 20 Hz) can be set in 0x2911:001
Operating element 2, lockable	Local control/network control	Right position = network control Left position = local control via operating element 1

"Extension box with disconnect switch with status feedback, operating element and potentiometer” option

Communication with the extension box takes place via X3.3 using IO-Link.

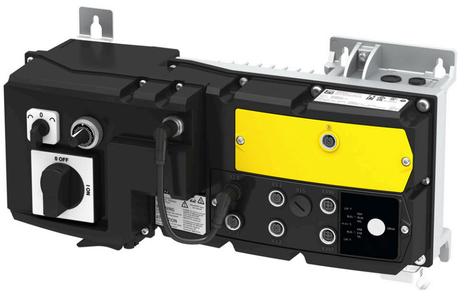
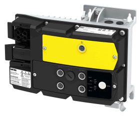


Fig. 4: Example for i550 motec with "Extension box with disconnect switch with status feedback, operating element, and potentiometer” option

Operating element	Function	Details
Disconnect switch	Mains voltage on/off	Position "I ON" = mains voltage On Position "0 OFF" = mains voltage Off Status feedback can be configured in the »EASY Starter«.
Operating element 1	Forward/Reverse/Stop	Right position = let motor rotate forward (CW) with set setpoint frequency Left position = let motor rotate reverse (CCW) with set setpoint frequency Position "0" = stop motor
Potentiometer	Setpoint frequency	The potentiometer is mapped to analog input 1 via the analog input configuration for IO-Link port 3. The scaled analog value is set in 0x2860:001 as the default setpoint source for frequency control.



5.9 Motor data

The term "motor data" comprises all parameters only depending on the motor and only characterising the electrical behaviour of the motor. Motor data are independent of the application in which the inverter and the motor are used.

Preconditions

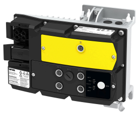
The equivalent circuit data ("Settings" tab, path: "Basic setting\motor", parameterisation dialog "Derived motor properties and equivalent circuit") apply to a motor in star connection. In case of a motor in delta connection, the delta values must be converted into equivalent star values.

Possible settings

If a Lenze motor is connected to the inverter, you can select the motor in the engineering tool from the "motor catalogue".

- For details see chapter "Select motor from motor catalog". 47

Otherwise the motor data must be set manually (for details see chapter "Manual setting of the motor data"). 48



5.9.1 Select motor from motor catalog

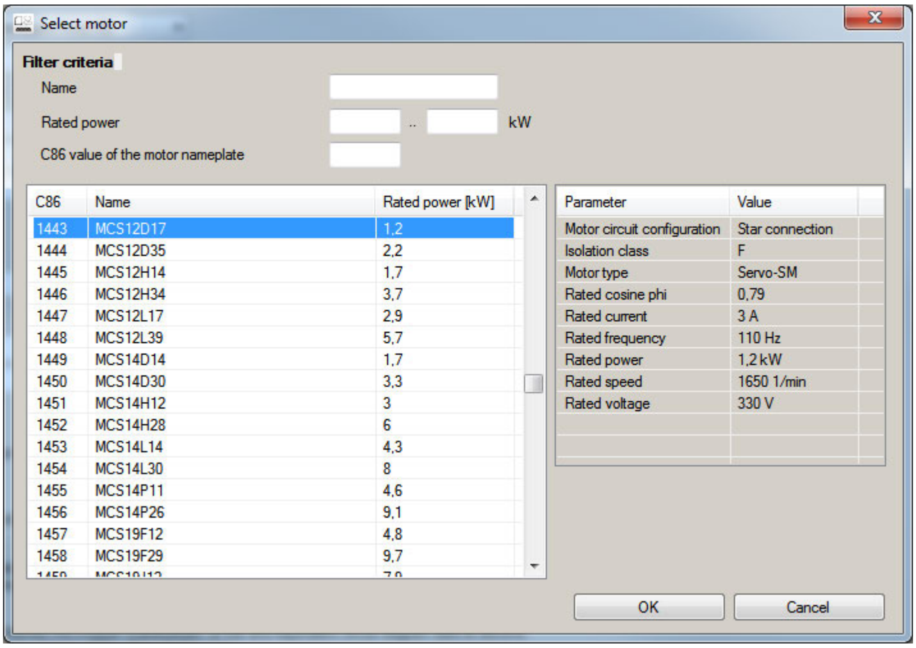
The following describes how to parameterise your drive system by selecting a Lenze motor from the motor catalogue. Several processes are started invisibly in the background to load/calculate the settings for the relevant parameters.

Preconditions

- Access to a Lenze engineering tool (e. g. »EASY Starter«).
- Parameters can be set online or offline (with or without connected motor).

Required steps

1. Open the Lenze engineering tool that provides for the functionality of a “Motor catalog".
2. Click the **Select motor...** button. In case of the »EASY Starter«, you find the **Select motor...** button on the "settings". tab.
3. Select the motor used in the "Select motor" dialog:



By entering filter criteria, you can restrict the selection.

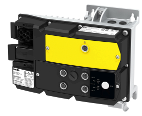
Name (e. g. "MCS..."), rated power and C86 value can be found on the motor nameplate.

4. Press the **Please select** button to select the thermal sensor.

   This is not required for all motors. For older motors, such as MDSKA056-22 (C86=10), a thermal sensor **CANNOT** be selected.

Observe the notes on the **?** button.

5. Click the **OK** button to start the optimisation.



Parameterisation sequence

As soon as the parameterisation has been started, the following steps are initiated by the engineering tool:

1. The motor rating data and the motor equivalent circuit diagram data are loaded from the motor catalogue.
2. The motor controller settings and the speed controller settings are automatically calculated based on the previously loaded data.

Notes:

- The data involved in this parameterisation are provided be the motor catalog alone. Further user data is not required.
- The inverter characteristic is not changed by this optimisation.

Parameter

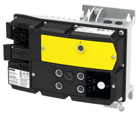
Address	Name / setting range / [default setting]	Information
0x2C01:010	Motor parameters: Motor name ["**Default Motor**"]	The name (e.g. " 1") can be freely selected by the user. If the motor in the engineering tool has been selected from the "motor catalog", the respective motor name is automatically entered here (example: "MDSKA080-22, 70").

5.9.2 Manual setting of the motor data

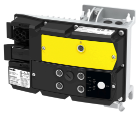
Manually set the motor data in accordance with the manufacturer's information / motor data sheet in the following parameters, provided that a third party motor is connected to the inverter.

Parameter

Address	Name / setting range / [default setting]	Information
0x2910:001	Inertia settings: Motor moment of inertia 0.00 ... [**3.70**] ... 20000000.00 kg cm²	Setting of the moment of inertia of the motor, relating to the motor.
0x2C01:001	Motor parameters: Number of pole pairs • Read only	Display of the number of pole pairs calculated from the rated speed and rated frequency.
0x2C01:002	Motor parameters: Stator resistance 0.0000 ... [**13.5000**] ... 125.0000 Ω	General motor data. Carry out settings as specified by manufacturer data/motor data sheet. Note! When you enter the motor nameplate data, take into account the phase connection implemented for the motor (star or delta connection). Only enter the data applying to the connection type selected.
0x2C01:003	Motor parameters: Stator leakage inductance 0.000 ... [**51.000**] ... 500.000 mH	
0x2C01:004	Motor parameters: Rated speed 50 ... [**1450**] ... 50000 rpm	General motor data. Carry out settings as specified by motor nameplate data. Note! When you enter the motor nameplate data, take into account the phase connection implemented for the motor (star or delta connection). Only enter the data applying to the connection type selected.
0x2C01:005	Motor parameters: Rated frequency 1.0 ... [**50.0**] ... 1000.0 Hz	
0x2C01:006	Motor parameters: Rated power 0.00 ... [**0.25**] ... 655.35 kW	
0x2C01:007	Motor parameters: Rated voltage 0 ... [**230**] ... 65535 V	
0x2C01:008	Motor parameters: Cosine phi 0.00 ... [**0.80**] ... 1.00	
0x2C02:003	Motor parameter (ASM): Magnetising current 0.00 ... [**0.96**] ... 500.00 A	Equivalent circuit data required for the motor model of the asynchronous machine.
0x2C03:001	Motor parameter (PSM): Back EMF constant 0.0 ... [**41.8**] ... 100000.0 V/1000rpm	Voltage induced by the motor (rotor voltage / 1000 rpm). For permanently excited synchronous motors, the e.m.f. constant describes the r.m.s. value of the line-to-line voltage (phase voltage) induced in idle state by the motor (reference: 1000 rpm, 20 °C). Measured: Line to Line (L - L)



Address	Name / setting range / [default setting]	Information
0x6075	Rated motor current 0.001 ... [**1.420**] ... 500.000 A • Setting can only be changed if the inverter is disabled.	The rated motor current that needs to be set here serves as a reference value for different parameters that involve a setting for/display of a current value in percent. Example: • Rated motor current = 1.7 A • Max. current 0x6073 = 200 % Rated motor current = 3.4 A
0x6076	Rated motor torque 0.001 ... [**1.650**] ... 4294967.295 Nm • Setting can only be changed if the inverter is disabled.	The rated motor torque to be set here serves as a reference value for different parameters with a setting/display of a torque value in percent. Example: • Rated motor torque = 1.65 Nm • Max. torque 0x6072 = 250 % Rated motor torque = 4.125 Nm
0x6080	Max. motor speed 0 ... [**6075**] ... 480000 rpm	Limitation of the max. motor speed. Depending on the parameter setting of 0x2D44:001 (Overspeed monitoring: threshold), the speed limitation (0x6080 / Max. motor speed) may become active before speed monitoring.



5.10 Motor control mode

The inverter supports different modes for closed-loop/open-loop motor control.

Parameter

Address	Name / setting range / [default setting]		Information
0x2C00	Motor control mode • Setting can only be changed if the inverter is disabled.		Selection of the motor control mode.
	2	Servo control (SC ASM)	This control mode is used for servo control of an asynchronous motor. A motor encoder must be connected to the inverter. This motor encoder is used as a feedback system for the motor control. ▸ Servo control for asynchronous motor (SC-ASM) 🕮 115
	4	Sensorless vector control (SLVC)	This control type is used for sensorless vector control of an asynchronous motor. ▸ Sensorless vector control (SLVC) 🕮 116
	6	**V/f characteristic control (VFC open loop)**	This control mode is used for the speed control of an asynchronous motor via a V/f characteristic and is the simplest control mode. ▸ V/f characteristic control for asynchronous motor (VFC open loop) 🕮 118
	7	V/f characteristic control (VFC closed loop)	The control mode is used for speed control of an asynchronous motor via a V/f characteristic with speed feedback. A motor encoder must be connected to the inverter. This motor encoder is used as a feedback system for the motor control. ▸ V/f characteristic control for asynchronous motor (VFC closed loop) 🕮 137
	8	Sensorless control for synchronous motors (SLSM-PSM)	This control type is used for the sensorless control of a synchronous motor. ▸ Sensorless control for synchronous motor (SLSM-PSM) 🕮 139

The detailed description of each motor control type can be found in the chapter "Configuring the motor control". 🕮 113

6 Start, stop and rotating direction commands

6.1 Control selection

The inverter receives its start, stop, and direction of rotation commands from the selected "control source".

Possible control sources:

- Control connections (digital inputs)
- Network

Details

- Preconfigured is a control of the inverter via the control connections. For details see subchapter "Flexible I/O configuration". 📖 51
- For details of the network control of the inverter, see the chapter "Control the inverter via network". 📖 255
- The control source that is currently active is displayed in 0x282B:001.

6.1.1 Flexible I/O configuration

Use parameters 0x2631:xx to individually adapt the inverter control to the respective application. This is basically effected by assigning digital control sources ("triggers") to functions of the inverter.

NOTICE

A digital signal source can be assigned to several functions.

Possible consequences: Unforeseeable behaviour of the drive in case of incorrect assignment

▶ Carry out assignment of a digital signal source to several functions with greater care.

Details

- Each subcode of 0x2631 is permanently assigned to a specific function. Functions are for example "Enable inverter", "Activate quick stop" or "Start forward (CW)".
- For a function, exactly one (digital) trigger can be set:

Trigger	*Function*
Digital input 1	Run

- Possible triggers include the digital inputs and internal status signals of the inverter.
- A list of all available triggers can be found in the "Trigger list". 📖 58
- If the trigger condition is met, the corresponding function is executed.

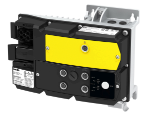
Example: changing the function assignment of a digital input

Task for this example:

1. The preset assignment of the digital input 2 for the function "Reset fault" is to be cancelled.
2. Instead, the digital input 2 is to be assigned to the "Activate DC braking" function.

   For this purpose, the following two settings are required:

	Function		*Trigger*	*Function*
Default:	0x2631:004	=	Digital input 2 [12]	Reset error
New: 1.	0x2631:004	=	Not connected [0]	Reset error
2.	0x2631:005	=	Digital input 2 [12]	Activate DC braking



6.2 Flexible I/O configuration of the start, stop and rotating direction commands

Configuration of the triggers for the basic functions for controlling the motor.

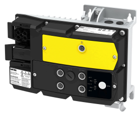
Details

The following table contains a short overview of the basic functions. For more details see the following parameter descriptions.

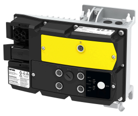
Function	Information
Enable inverter 0x2631:001	Enable/disable operation. • The function must be set to TRUE to start the motor. Either via a digital input or the default setting "Constant TRUE [1]". • If the function is set to FALSE, the inverter is disabled. The motor has no torque (is coasting). ▸ Example: Enable inverter 📖 67
Run 0x2631:002	Function 1: Start / stop motor (default setting) • Function 1 is active if no further start commands (start forward/start reverse) have been connected to triggers and no network control is active. TRUE: Let motor rotate forward (CW). FALSE: Stop the motor. ▸ Example: Start/stop (1 signal) and reversal 📖 60
	Function 2: Start enable/stop motor • Function 2 is active if further start commands have been connected to triggers or network control is active. TRUE: Start commands of the active control source are enabled. FALSE: Stop the motor. ▸ Example: Start forward/start reverse/stop (edge-controlled) 📖 61 ▸ Example: Run forward/Run reverse/stop (status-controlled) 📖 63
Activate quick stop 0x2631:003	Bring the motor to a standstill in best time. ▸ Example: Quick stop 📖 65
Start forward (CW) 0x2631:006 Start reverse (CCW) 0x2631:007	Start the motor edge-controlled. • In order to be able to start the motor, the "Run" function must be set to TRUE. • The motor is stopped by resetting the "Run" function to FALSE. • The functions are deactivated for network control. ▸ Example: Start forward/start reverse/stop (edge-controlled) 📖 61
Run forward (CW) 0x2631:008 Run reverse (CCW) 0x2631:009	Let the motor rotate in a status-controlled way. • In order to be able to start the motor, the "Run" function must be set to TRUE. • The functions are deactivated for network control. ▸ Example: Run forward/Run reverse/stop (status-controlled) 📖 63
Jog foward (CW) 0x2631:010 Jog reverse (CCW) 0x2631:011	Jog operation: Let the motor rotate in a status-controlled way with setpoint preset. ⚠ CAUTION! The jog operation has a higher priority than the "Run" function, all other start commands. • If the jog operation is active, the motor cannot be stopped with the previously mentioned functions! • However, jog operation can be interrupted by the "Quick stop" function. • Jog operation can always be activated, even in case of network control. ▸ Example: Jog forward/Jog reverse 📖 68
Reverse rotational direction 0x2631:013	Invert the frequency setpoint. • The function can be used in combination with all start commands. • The function is deactivated in the case of network control. ▸ Example: Start/stop (1 signal) and reversal 📖 60

Parameter

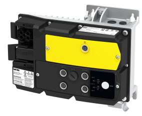
Address	Name / setting range / [default setting]	Information
0x2631:001	Function list: Enable inverter • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Enable inverter" function. Trigger = TRUE: The inverter is enabled (unless there is another cause for inverter disable). Trigger = FALSE: The inverter is disabled. Notes: • This function must be set to TRUE to start the motor. The signal TRUE is activated either via an assigned digital input or the default setting "Constant TRUE [1]". • Changing to the inhibited state causes an immediate stop of the motor, regardless of the stop method set in 0x2838:003. The motor has no torque and coasts down. • The cause(s) for the inhibited state are shown in 0x282A:001. ▸ Example: Enable inverter 📖 67
	1 Constant TRUE	Trigger is constantly TRUE.
0x2631:002	Function list: Run • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger to the "Run". **Function 1: Start / stop motor (default setting)** Function 1 is active if no further start commands (start forward/start reverse) have been connected to triggers and no network control is active. Trigger = TRUE: Let motor rotate forward (CW). Trigger = FALSE: Stop motor. Notes to function 1: • If "Enable inverter" 0x2631:001 = "Constant TRUE [1]", only a digital input is permissible as trigger for this function in order that the motor can be stopped again any time. Exception: If the "Safe torque off (STO)" safety function is available, both functions "Enable inverter" and "Run" can be set to "Constant TRUE [1]". The inverter is then controlled via the STO signal unless no other start commands (start forward/start reverse) have been connected to triggers. • The stop method can be selected in 0x2838:003. • The function also serves to realize an automatic start after switch-on. ▸ Start behavior 📖 39 ▸ Example: Start/stop (1 signal) and reversal 📖 60 **Function 2: Start enable/stop motor** Function 2 is active if further start commands have been connected to triggers or network control is active. Trigger = TRUE: Start commands of the active control source are enabled. Trigger = FALSE: Stop motor. Notes to function 2: • If no separate start enable is required for the application, the trigger "Constant TRUE [1]" must be set. • The stop method can be selected in 0x2838:003. ▸ Example: Start forward/start reverse/stop (edge-controlled) 📖 61 ▸ Example: Run forward/Run reverse/stop (status-controlled) 📖 63
	11 Digital input 1	State of X3/DI1, taking an inversion set in 0x2632:001 into consideration.
0x2631:003	Function list: Activate quick stop • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate quick stop" function. Trigger = TRUE: Activate quick stop. Trigger = FALSE: Deactivate quick stop. Notes: • The "Quick stop" function brings the motor to a standstill within the deceleration time set in 0x291C. ▸ Example: Quick stop 📖 65
	0 Not connected	No trigger assigned (trigger is constantly FALSE).



Address	Name / setting range / [default setting]	Information
0x2631:006	Function list: Start forward (CW) • Setting can only be changed if the inverter is disabled. • Further possible settings: Trigger list 58	Assignment of a trigger for the "Start forward (CW)" function. Trigger = FALSE↗TRUE (edge): Let motor rotate forward. Trigger = TRUE↘FALSE (edge): No action. Notes: • In order to start the motor, "Enable inverter" 0x2631:001 and "Run" 0x2631:002 must be set to TRUE. • After the start, the motor runs until "Run" is set to FALSE, another stop command is given or the inverter is disabled. • In the case of a bipolar setpoint selection (e.g. ±10 V), the function is executed independent of the direction of rotation. The rotating direction is determined by the sign of the setpoint. Example: Start forward/start reverse/stop (edge-controlled) 61
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:007	Function list: Start reverse (CCW) • Setting can only be changed if the inverter is disabled. • Further possible settings: Trigger list 58	Assignment of a trigger for the "Start reverse (CCW)" function Trigger = FALSE↗TRUE (edge): Let motor rotate backward. Trigger = TRUE↘FALSE (edge): No action. Notes: • In order to start the motor, "Enable inverter" 0x2631:001 and "Run" 0x2631:002 must be set to TRUE. • After the start, the motor runs until "Run" is set to FALSE, another stop command is given or the inverter is disabled. • In the case of a bipolar setpoint selection (e.g. ±10 V), the function is executed independent of the direction of rotation. The rotating direction is determined by the sign of the setpoint. Example: Start forward/start reverse/stop (edge-controlled) 61
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:008	Function list: Run forward (CW) • Setting can only be changed if the inverter is disabled. • Further possible settings: Trigger list 58	Assignment of a trigger for the "Run forward (CW)" function. Trigger = TRUE: Let motor rotate forward. Trigger = FALSE: Stop motor. Notes: • In order to start the motor, "Enable inverter" 0x2631:001 and "Run" 0x2631:002 must be set to TRUE. • The inverter always responds to the run command detected last. A start enable must exist. • The stop method can be selected in 0x2838:003. • In the case of a bipolar setpoint selection (e.g. ±10 V), the function is executed independent of the direction of rotation. The rotating direction is determined by the sign of the setpoint. • The "Run forward (CW)" function also serves to realise an automatic start after switch-on. Start behavior 39 Example: Run forward/Run reverse/stop (status-controlled) 63
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:009	Function list: Run reverse (CCW) • Setting can only be changed if the inverter is disabled. • Further possible settings: Trigger list 58	Assignment of a trigger for the "Run reverse (CCW)" function. Trigger = TRUE: Let motor rotate backward. Trigger = FALSE: Stop motor. Notes: • In order to start the motor, "Enable inverter" 0x2631:001 and "Run" 0x2631:002 must be set to TRUE. • The inverter always responds to the run command detected last. A start enable must exist. • The stop method can be selected in 0x2838:003. • In the case of a bipolar setpoint selection (e.g. ±10 V), the function is executed independent of the direction of rotation. The rotating direction is determined by the sign of the setpoint. • The "Run reverse (CCW)" function also serves to realise an automatic start after switch-on. Start behavior 39 Example: Run forward/Run reverse/stop (status-controlled) 63
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).

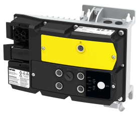


Address		Name / setting range / [default setting]	Information
0x2631:010		Function list: Jog foward (CW) • Setting can only be changed if the inverter is disabled.	Assignment of a trigger for the "Jog foward (CW)" function. Trigger = TRUE: Let motor rotate forward with preset 5. Trigger = FALSE: Stop motor. ⚠ CAUTION! The jog operation has a higher priority than the "Run" function, all other start commands. • If jog operation is active, the motor cannot be stopped with the previously mentioned functions! • However, jog operation can be interrupted by the "Quick stop" function. Notes: • The preset 5 can be set in 0x2911:005. • The stop method can be selected in 0x2838:003. • If "Jog foward (CW)" and "Jog reverse (CCW)" are activated at the same time, the motor is stopped using the set stop method and jog operation must be triggered again. • Jog operation cannot be started automatically. The "Start at power-up" option in 0x2838:002 does not apply to jog operation. ▶ Example: Jog forward/Jog reverse 📖 68
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
	11	Digital input 1	State of X3/DI1, taking an inversion set in 0x2632:001 into consideration.
	12	Digital input 2	State of X3/DI2, taking an inversion set in 0x2632:002 into consideration.
	13	Digital input 3	State of X3/DI3, taking an inversion set in 0x2632:003 into consideration.
	14	Digital input 4	State of X3/DI4, taking an inversion set in 0x2632:004 into consideration.
	15	Digital input 5	State of X3/DI5, taking an inversion set in 0x2632:005 into consideration.
	16	Digital input 6	State of X3/DI6, taking an inversion set in 0x2632:006 into consideration.
	17	Digital input 7	State of X3/DI7, taking an inversion set in 0x2632:007 into consideration.
	18	Digital input 8	State of X3/DI8, taking an inversion set in 0x2632:008 into consideration.
	50	Running	TRUE if inverter and start are enabled and output frequency > 0 Hz. Otherwise FALSE. Exception, quick stop mode: TRUE if inverter and start are enabled and output frequency > 0.2 Hz. Otherwise FALSE.
	51	Ready for operation	TRUE if inverter is ready for operation (no error active, no STO active and DC-bus voltage ok). Otherwise FALSE.
	53	Stop active	TRUE if inverter is enabled and motor is not started and output frequency = 0.
	54	Quick stop active	TRUE if quick stop is active. Otherwise FALSE.
	58	Device warning active	TRUE if warning is active. Otherwise FALSE. • A warning has no impact on the operating status of the inverter. • A warning is reset automatically if the cause has been eliminated.
	59	Device trouble active	TRUE if a fault is active. Otherwise FALSE. • In the event of a fault, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. • Exception: In case of a serious fault, the inverter is disabled immediately. The motor has no torque (coasts). • The error state will be left automatically if the error condition is not active anymore. • The restart behaviour after trouble can be configured. ▶ Automatic restart after a fault 📖 399
	60	Heatsink temperature warning active	TRUE if current heatsink temperature > warning threshold for temperature monitoring. Otherwise FALSE. • Display of the current heatsink temperature in 0x2D84:001. • Setting of the warning threshold in 0x2D84:002.
	68	Stop command active	TRUE if delay to standstill active. Otherwise FALSE.
	69	Rotational direction reversed	TRUE if output frequency is negative. Otherwise FALSE.



Address	Name / setting range / [default setting]		Information
	70	Frequency threshold exceeded	TRUE if current output frequency > frequency threshold. Otherwise FALSE. • Display of the current output frequency in 0x2DDD. • Setting Frequency threshold in 0x4005. ▶ Trigger action if a frequency threshold is exceeded 📖 421
	71	Actual speed = 0	TRUE if actual output frequency = 0 Hz (± 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD.
	78	Current limit reached	TRUE if current motor current ≥ maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88. • Setting for the maximum current in 0x6073.
	79	Torque limit reached	TRUE if torque limit has been reached or exceeded. Otherwise FALSE. • Setting "Actual positive torque limit" in 0x2949:003. • Setting "Actual negative torque limit" in 0x2949:004. ▶ Motor torque monitoring 📖 184
	83	Load loss detected	TRUE if actual motor current < threshold for load loss detection after delay time of the load loss detection has elapsed. Otherwise FALSE. • Display of the actual current in 0x6078. • Setting Threshold in 0x4006:001. • Setting Delay time in 0x4006:002. ▶ Load loss detection 📖 160
	84	Heavy load monitoring	TRUE if the actual apparent current of the motor exceeds the threshold for longer than the delay time. FALSE if the actual apparent current of the motor falls below the threshold value minus 5 % (hysteresis). ▶ Heavy load monitoring 📖 187

Address	Name / setting range / [default setting]		Information
	224	X3.1 IOL1 BI1 value	Binary values received via IO-Link corresponding to the binary input configuration for the respective IO-Link port. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 188 ▸ Configure IO-Link ports 205
	225	X3.1 IOL1 BI2 value	
	226	X3.1 IOL1 BI3 value	
	227	X3.1 IOL1 BI4 value	
	228	X3.1 IOL1 BI5 value	
	229	X3.1 IOL1 BI6 value	
	230	X3.1 IOL1 BI7 value	
	231	X3.1 IOL1 BI8 value	
	232	X3.2 IOL2 BI1 value	
	233	X3.2 IOL2 BI2 value	
	234	X3.2 IOL2 BI3 value	
	235	X3.2 IOL2 BI4 value	
	236	X3.2 IOL2 BI5 value	
	237	X3.2 IOL2 BI6 value	
	238	X3.2 IOL2 BI7 value	
	239	X3.2 IOL2 BI8 value	
	240	X3.3 IOL3 BI1 value	
	241	X3.3 IOL3 BI2 value	
	242	X3.3 IOL3 BI3 value	
	243	X3.3 IOL3 BI4 value	
	244	X3.3 IOL3 BI5 value	
	245	X3.3 IOL3 BI6 value	
	246	X3.3 IOL3 BI7 value	
	247	X3.3 IOL3 BI8 value	
	248	X3.4 IOL4 BI1 value	
	249	X3.4 IOL4 BI2 value	
	250	X3.4 IOL4 BI3 value	
	251	X3.4 IOL4 BI4 value	
	252	X3.4 IOL4 BI5 value	
	253	X3.4 IOL4 BI6 value	
	254	X3.4 IOL4 BI7 value	
	255	X3.4 IOL4 BI8 value	
0x2631:011	Function list: Jog reverse (CCW) • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x2631:010. 55		Assignment of a trigger for the "Jog reverse (CCW)" function. Trigger = TRUE: Let motor rotate backward with preset 6. Trigger = FALSE: Stop motor. ⚠ CAUTION! The jog operation has a higher priority than the "Run" function, all other start commands. • If jog operation is active, the motor cannot be stopped with the previously mentioned functions! • However, jog operation can be interrupted by the "Quick stop" function. Notes: • The preset 6 can be set in 0x2911:006. • The stop method can be selected in 0x2838:003. • If "Jog foward (CW)" and "Jog reverse (CCW)" are activated at the same time, the motor is stopped using the set stop method and jog operation must be triggered again. • Jog operation cannot be started automatically. The "Start at power-up" option in 0x2838:002 does not apply to jog operation. ▸ Example: Jog forward/Jog reverse 68
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).



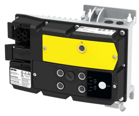
Address	Name / setting range / [default setting]	Information
0x2631:013	Function list: Reverse rotational direction • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Reverse rotational direction" function. Trigger = TRUE: the setpoint specified is inverted (i. e. the sign is inverted). Trigger = FALSE: no action / deactivate function again. ▸ Example: Start/stop (1 signal) and reversal 📖 60
	13 **Digital input 3**	State of X3/DI3, taking an inversion set in 0x2632:003 into consideration.

6.2.1 Trigger list

The trigger list lists all selection options (triggers) for the functions which can be configured using the parameters 0x2631:xxx.

Selection		Information
0	Not connected	No trigger assigned (trigger is constantly FALSE).
1	Constant TRUE	Trigger is constantly TRUE.
11	Digital input 1	State of X3/DI1, taking an inversion set in 0x2632:001 into consideration.
12	Digital input 2	State of X3/DI2, taking an inversion set in 0x2632:002 into consideration.
13	Digital input 3	State of X3/DI3, taking an inversion set in 0x2632:003 into consideration.
14	Digital input 4	State of X3/DI4, taking an inversion set in 0x2632:004 into consideration.
15	Digital input 5	State of X3/DI5, taking an inversion set in 0x2632:005 into consideration.
16	Digital input 6	State of X3/DI6, taking an inversion set in 0x2632:006 into consideration.
17	Digital input 7	State of X3/DI7, taking an inversion set in 0x2632:007 into consideration.
18	Digital input 8	State of X3/DI8, taking an inversion set in 0x2632:008 into consideration.
50	Running	TRUE if inverter and start are enabled and output frequency > 0 Hz. Otherwise FALSE. Exception, quick stop mode: TRUE if inverter and start are enabled and output frequency > 0.2 Hz. Otherwise FALSE.
51	Ready for operation	TRUE if inverter is ready for operation (no error active, no STO active and DC-bus voltage ok). Otherwise FALSE.
53	Stop active	TRUE if inverter is enabled and motor is not started and output frequency = 0.
54	Quick stop active	TRUE if quick stop is active. Otherwise FALSE.
58	Device warning active	TRUE if warning is active. Otherwise FALSE. • A warning has no impact on the operating status of the inverter. • A warning is reset automatically if the cause has been eliminated.
59	Device trouble active	TRUE if a fault is active. Otherwise FALSE. • In the event of a fault, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. • Exception: In case of a serious fault, the inverter is disabled immediately. The motor has no torque (coasts). • The error state will be left automatically if the error condition is not active anymore. • The restart behaviour after trouble can be configured. ▸ Automatic restart after a fault 📖 399
60	Heatsink temperature warning active	TRUE if current heatsink temperature > warning threshold for temperature monitoring. Otherwise FALSE. • Display of the current heatsink temperature in 0x2D84:001. • Setting of the warning threshold in 0x2D84:002.
68	Stop command active	TRUE if delay to standstill active. Otherwise FALSE.
69	Rotational direction reversed	TRUE if output frequency is negative. Otherwise FALSE.
70	Frequency threshold exceeded	TRUE if current output frequency > frequency threshold. Otherwise FALSE. • Display of the current output frequency in 0x2DDD. • Setting Frequency threshold in 0x4005. ▸ Trigger action if a frequency threshold is exceeded 📖 421
71	Actual speed = 0	TRUE if actual output frequency = 0 Hz (± 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD.

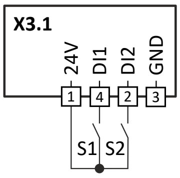
Selection		Information
78	Current limit reached	TRUE if current motor current ≥ maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88. • Setting for the maximum current in 0x6073.
79	Torque limit reached	TRUE if torque limit has been reached or exceeded. Otherwise FALSE. • Setting "Actual positive torque limit" in 0x2949:003. • Setting "Actual negative torque limit" in 0x2949:004. ▸ Motor torque monitoring 📖 184
83	Load loss detected	TRUE if actual motor current < threshold for load loss detection after delay time of the load loss detection has elapsed. Otherwise FALSE. • Display of the actual current in 0x6078. • Setting Threshold in 0x4006:001. • Setting Delay time in 0x4006:002. ▸ Load loss detection 📖 160
84	Heavy load monitoring	TRUE if the actual apparent current of the motor exceeds the threshold for longer than the delay time. FALSE if the actual apparent current of the motor falls below the threshold value minus 5 % (hysteresis). ▸ Heavy load monitoring 📖 187
224	X3.1 IOL1 BI1 value	Binary values received via IO-Link corresponding to the binary input configuration for the respective IO-Link port. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
225	X3.1 IOL1 BI2 value	
226	X3.1 IOL1 BI3 value	
227	X3.1 IOL1 BI4 value	
228	X3.1 IOL1 BI5 value	
229	X3.1 IOL1 BI6 value	
230	X3.1 IOL1 BI7 value	
231	X3.1 IOL1 BI8 value	
232	X3.2 IOL2 BI1 value	
233	X3.2 IOL2 BI2 value	
234	X3.2 IOL2 BI3 value	
235	X3.2 IOL2 BI4 value	
236	X3.2 IOL2 BI5 value	
237	X3.2 IOL2 BI6 value	
238	X3.2 IOL2 BI7 value	
239	X3.2 IOL2 BI8 value	
240	X3.3 IOL3 BI1 value	
241	X3.3 IOL3 BI2 value	
242	X3.3 IOL3 BI3 value	
243	X3.3 IOL3 BI4 value	
244	X3.3 IOL3 BI5 value	
245	X3.3 IOL3 BI6 value	
246	X3.3 IOL3 BI7 value	
247	X3.3 IOL3 BI8 value	
248	X3.4 IOL4 BI1 value	
249	X3.4 IOL4 BI2 value	
250	X3.4 IOL4 BI3 value	
251	X3.4 IOL4 BI4 value	
252	X3.4 IOL4 BI5 value	
253	X3.4 IOL4 BI6 value	
254	X3.4 IOL4 BI7 value	
255	X3.4 IOL4 BI8 value	



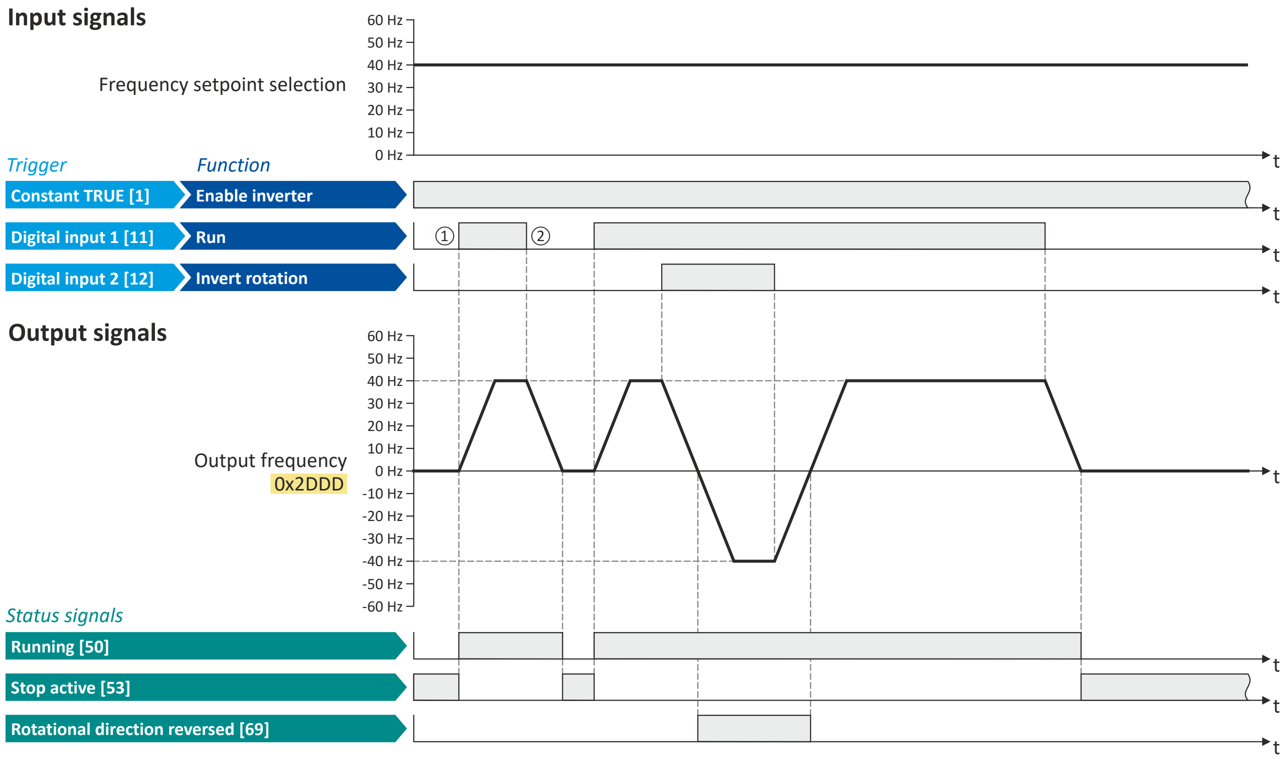
6.2.2 Example: Start/stop (1 signal) and reversal

This example shows a simple control option via two switches which should be sufficient for many applications:

- The switch S1 starts the motor in the forward direction of rotation. The switch S1 in the initial position stops the motor again.
- The switch S2 switches the direction of rotation.

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Reverse rotational direction

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:013	Reverse rotational direction	Digital input 2 [12]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz



The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① If the inverter is enabled and no error is active, the motor can be started with the "Run" function in forward rotating direction.

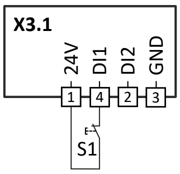
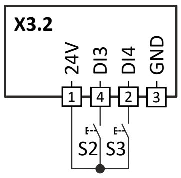
② If "Run" is set to FALSE, the motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp.

6.2.3 Example: Start forward/start reverse/stop (edge-controlled)

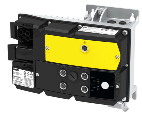
The "Run" function automatically becomes a "start enable" if the functions "Start forward (CW)"/"Start reverse (CCW)" are connected to triggers.

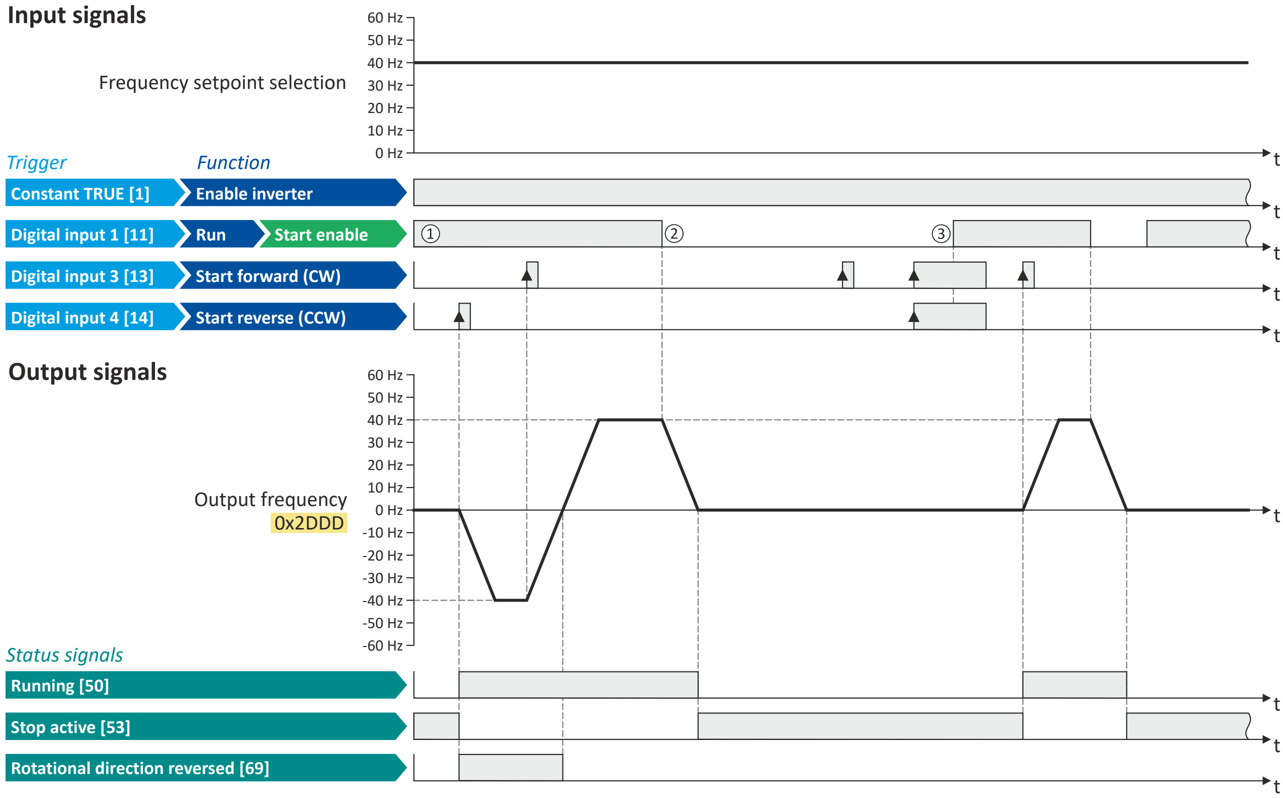
This example shows an edge-controlled start/stop via three buttons:

- In the non-operating state of button S1 (normally-closed contact), there is already a start enable.
- Button S2 starts the motor in forward rotating direction.
- Button S3 starts the motor in the reverse rotating direction.
- Button S1 (normally-closed contact) stops the motor by (momentary) cancellation of the start enable. The inverter then waits for the next start command via button S2/S3.

Connection diagram	Function	
 	Button S1	Stop
	Button S2	Start forward (CW)
	Button S3	Start reverse (CCW)

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:006	Start forward (CW)	Digital input 3 [13]
0x2631:007	Start reverse (CCW)	Digital input 4 [14]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz





The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① The "Run" function serves as start enable for the functions "Start forward (CW)" and "Start reverse (CCW)". Without start enable, the motor cannot be started.

② If the start enable is cancelled, the motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp.

③ If, at start enable, "Start forward (CW)" and "Start reverse (CCW)" are already set to TRUE, the motor remains stopped and the inverter waits for the next valid start edge.

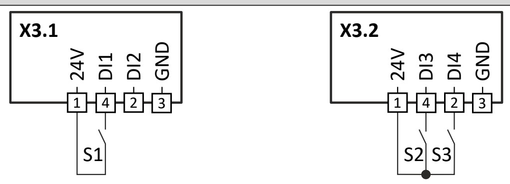
6.2.4 Example: Run forward/Run reverse/stop (status-controlled)

The "Run" function automatically becomes a "start enable" if the functions "Run forward (CW)"/"Run reverse (CCW)" are connected to triggers.

This example shows a status-controlled start/stop via three switches:

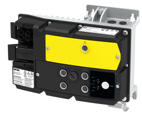
- Switch S1 enables the start. Without start enable, the motor cannot be started.
- Switch S2 starts the motor in forward direction of rotation.
- Switch S3 starts the motor in backward direction of rotation.
- The motor is stopped by cancelling the run commands (switches S2 and S3 open) or by cancelling the start enable (switch S1 open).

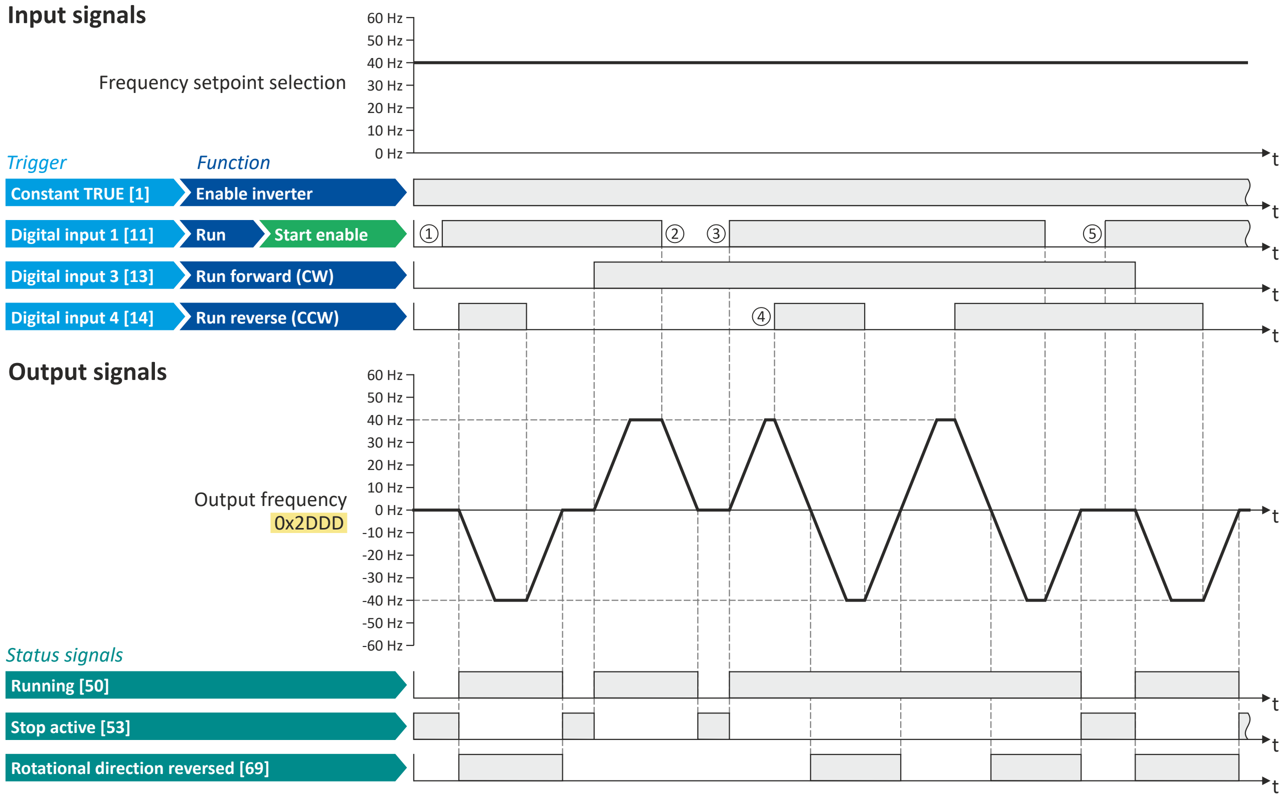
Connection diagram



Function	
Switch S1	Start enable
Switch S2	Run forward (CW)
Switch S3	Run reverse (CCW)

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:008	Run forward (CW)	Digital input 3 [13]
0x2631:009	Run reverse (CCW)	Digital input 4 [14]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz





The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① The "Run" function serves as start enable for the functions "Run forward (CW)" and "Run reverse (CCW)".
Without start enable, the motor cannot be started.

② If the start enable is cancelled, the motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp.
After a renewed start enable, the inverter waits for the next run command.

③ If, at start enable, either "Run forward (CW)" or "Run reverse (CCW)" is set to TRUE, the motor starts in the triggered direction.

④ The inverter always responds to the run command detected last (if start enable is available).
In the example, the "Run reverse (CCW)" command replaces the still active "Run forward (CW)" command.

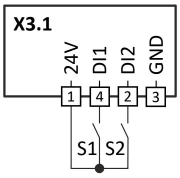
⑤ If, at start enable, both run commands are set to TRUE, the motor remains stopped until only one valid run command is available.

6.2.5 Example: Quick stop

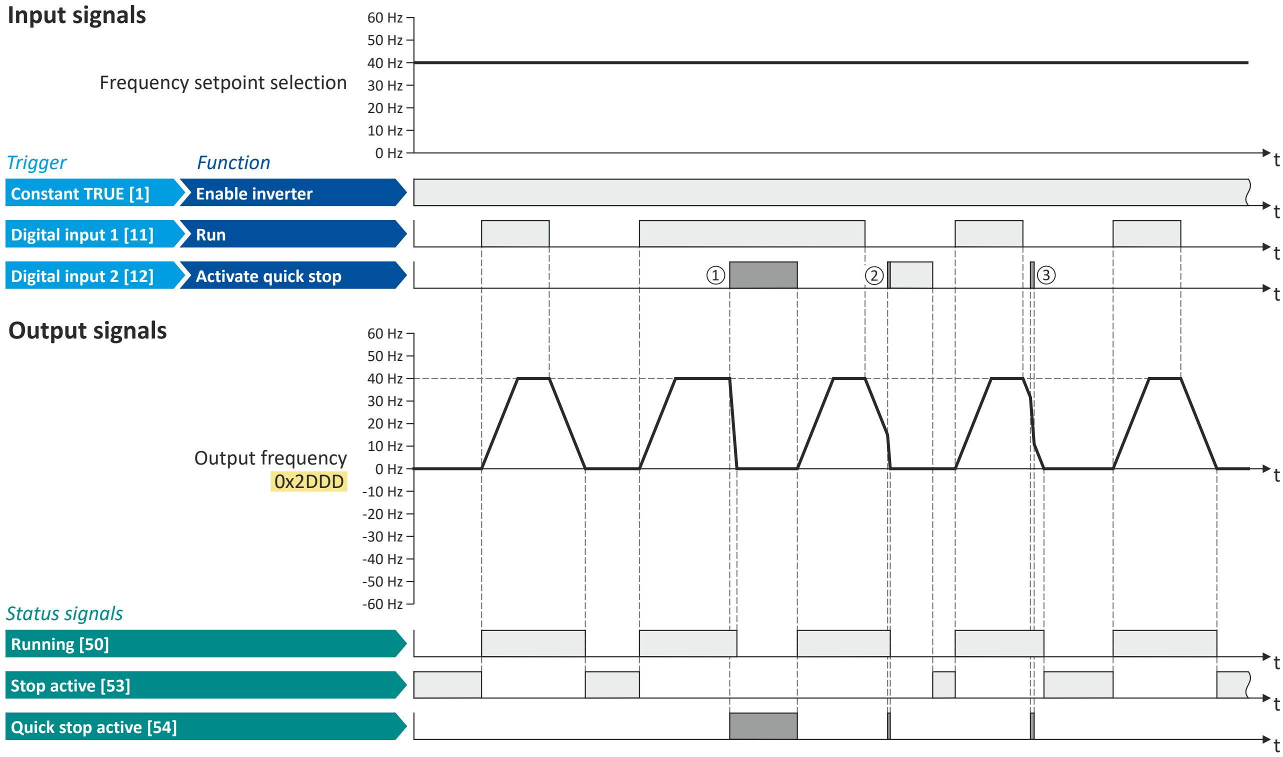
This example illustrates the "quick stop" function. If a quick stop is activated, the motor is brought to a standstill within the deceleration time set in 0x291C.

- The switch S1 starts the motor in the forward direction of rotation. The switch S1 in the initial position stops the motor again.
- The switch S2 activates the "quick stop" function.

Cancelling the quick stop causes a restart of the motor if the "Run” function is still active (switch S1 closed)!

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Activate quick stop

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:003	Activate quick stop	Digital input 2 [12]
0x2631:004	Reset fault	Not connected [0]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz
0x291D:001	Acceleration time 1	3.00 s
0x291D:002	Deceleration time 1	3.00 s
0x291C	Quick stop deceleration time	1.0 s

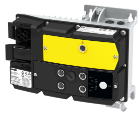


The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

① If a quick stop is activated, the motor is decelerated to the frequency setpoint 0 Hz within a short period of time. The "Quick stop active [54]" status is set as long as quick stop is activated. The "Stop active [53]" status is not set.

② An active stop command is interrupted by a quick stop.

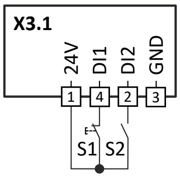
③ If quick stop is cancelled again before standstill is reached, stopping is continued with the stop method set in 0x2838:003. In the example: Stop with standard ramp.



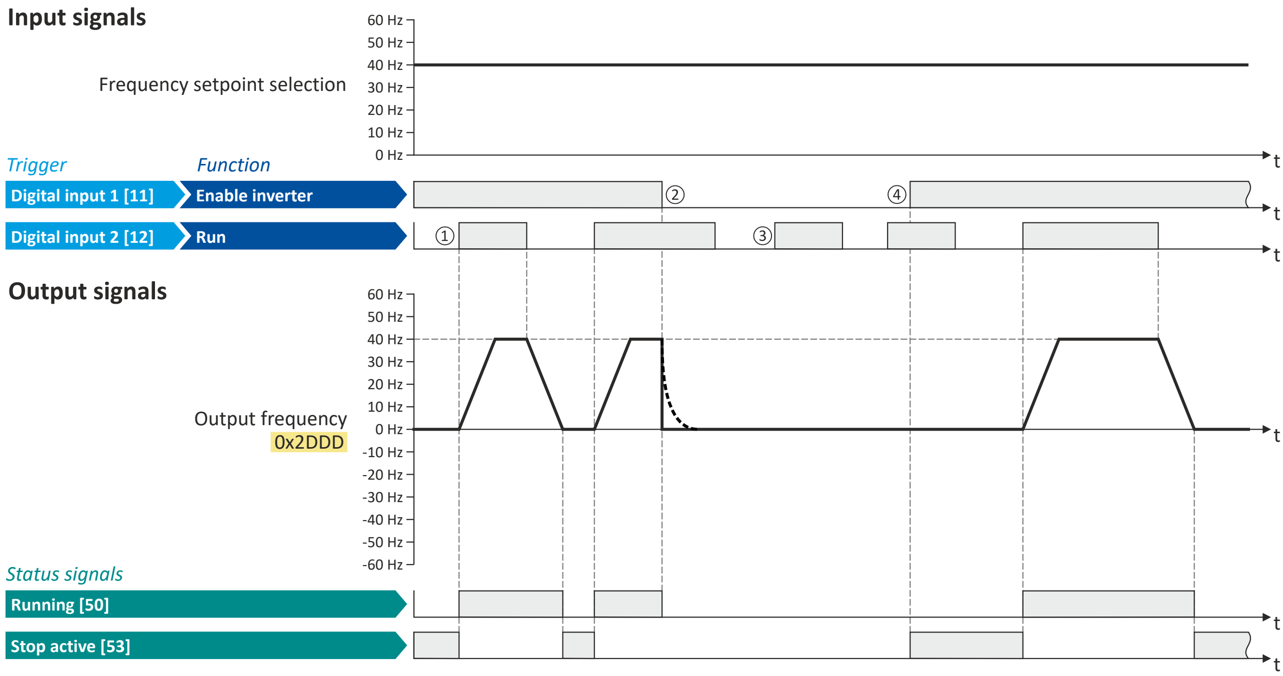
6.2.6 Example: Enable inverter

This example shows how to use the "Enable inverter" function for a separate enable input.

- In sleep mode of switch S1 (normally-closed contact), "Enable inverter" is already available.
- Switch S2 starts the motor in forward rotating direction (if switch S1 is closed). Switch S2 in initial position stops the motor again.
- Switch S1 disables the inverter. The motor has no torque (is coasting).

Connection diagram	Function	
	Switch S1	Disable inverter
	Switch S2	Run

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Digital input 1 [11])
0x2631:002	Run	Digital input 2 [12]
0x2631:004	Reset fault	Not connected [0]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz



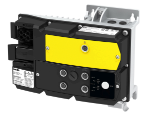
The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

① If the inverter is enabled and no error is active, the motor can be started with the "Run" function in forward rotating direction.

② If "Enable inverter" is set to FALSE, the inverter is disabled. The motor has no torque and coasts to standstill depending on the mass inertia of the machine.

③ Without "Enable inverter", the motor cannot be started.

④ In the default setting, the motor does not start if the "Run" function is set to TRUE during "Enable inverter". After "Enable inverter". "Run" must be retriggered to start the motor.
▸ Start behavior 📖 39



6.2.7 Example: Jog forward/Jog reverse

This example shows the functions "Jog forward (CW)" and "Jog reverse (CCW)" for Jog operation.

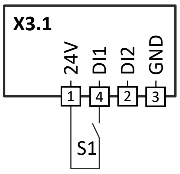
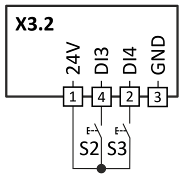
- The switch S1 starts the motor in the forward direction of rotation. The switch S1 in the initial position stops the motor again.
- The button S2 starts the motor in the forward direction of rotation with frequency preset 5.
- The button S3 starts the motor in the backward direction of rotation with frequency preset 6.
- The motor rotates in jog operation as long as the respective button is pressed. If both buttons are pressed at the same time, the motor is stopped.

⚠CAUTION!

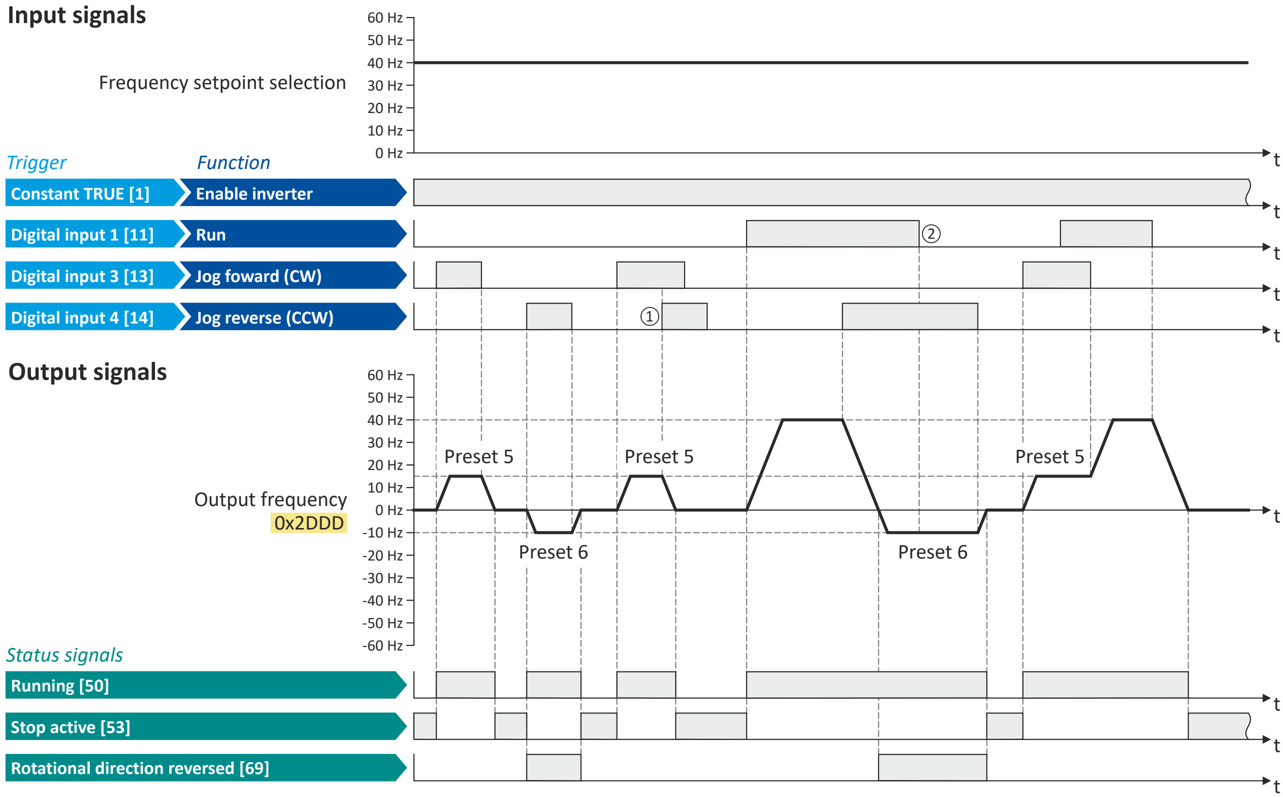
The jog operation has a higher priority than the "Run" function, all other start commands.

If jog operation is active, the motor cannot be stopped with the previously mentioned functions!

- ▶ The jog operation is stopped by cancelling the functions "Jog foward (CW)"/"Jog reverse (CCW)".
- ▶ The jog operation can be interrupted with the "Activate quick stop" 0x2631:003 function.

Connection diagram		Function	
		Switch S1	Run
		Button S2	Jog foward (CW)
		Button S3	Jog reverse (CCW)

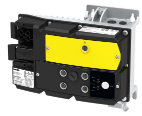
Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:010	Jog foward (CW)	Digital input 3 [13]
0x2631:011	Jog reverse (CCW)	Digital input 4 [14]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz
0x2911:005	Frequency setpoint presets: Preset 5	15.0 Hz (is used for jog forward)
0x2911:006	Frequency setpoint presets: Preset 6	10.0 Hz (is used for jog reverse)



The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① If "Jog forward (CW)" and "Jog reverse (CCW)" are activated at the same time, the motor is stopped with the stop method set in 0x2838:003 and the jog operation must be triggered again.

② The jog operation cannot be terminated with the "Run" function but only by cancelling the jog command.



6.3 Control/restrict direction of rotation of the motor

In the default setting, both directions of motor rotation are enabled. Optionally, the direction of rotation can be restricted so that only a clockwise rotation (CW) or counter-clockwise rotation (CCW) of the motor is possible.

Preconditions

Wiring of the motor phases must be carried out correctly with regard to the direction of motor rotation.

In the documentation and the parameter selection texts, the following terms are used for the direction of rotation:

- Forward = clockwise direction of rotation (CW)
- Reverse = counter-clockwise direction of rotation (CCW)

Details

The direction of rotation of the motor can be controlled in various ways:

- Via the function "Reverse rotational direction". Possible triggers for the "Reverse rotational direction" function in 0x2631:013 include the digital inputs and internal status signals of the inverter.
- Via the network. The definition of the direction of rotation is possible via the mappable NetWordIN1 data word or one of the predefined process data words.

If a reversal of rotation is not required, the direction of rotation can be restricted in 0x283A to "Only clockwise (CW) [0]" or "Only counter-clockwise (CCW) [2]".

Parameter

Address	Name / setting range / [default setting]		Information
0x283A	Limitation of rotation		Optional restriction of the rotating direction.
	0	Only clockwise (CW)	The motor can only be rotated clockwise (CW). The transfer of negative frequency and PID setpoints to the motor control is prevented. • This function takes effect after the "Reverse rotational direction" function (0x2631:013). • Since this function only prevents negative setpoints, counter-clockwise rotation (CCW) is possible if the motor has been wired for this rotating direction.
	1	**Both rotational directions**	Both directions of motor rotation are enabled.
	2	Only counter-clockwise (CCW)	The motor can only rotate counter-clockwise (CCW). Transmitting positive frequency and PID setpoints to the motor control is prevented. • This function takes effect after the "Reverse rotational direction" function (0x2631:013). • However, since this function only prevents positive setpoints, clockwise rotation (CW) is possible if the motor has been wired for this direction of rotation.

Related topics

▶ Example: Start/stop (1 signal) and reversal 📖 60

6.4 Changing the control source during operation

The term "control sources" in this connection refers to the digital signal sources from which the inverter receives its start, stop, and reversal commands.

Possible control sources:

- Digital inputs
- Network

Details

The "Activate network control" function can be used to switch from the "Digital inputs" control source to the "Network" control source during operation. The motor is then started via the network control word. The inverter not only supports such a changeover via its digital inputs, but also as a function of internal inverter states.

Parameter

Address	Name / setting range / [default setting]		Information
0x2631:037	Function list: Activate network control • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Activate network control" function. Trigger = TRUE: Activate network control. Trigger = FALSE: no action / deactivate network control again.
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
	114	Network control active	TRUE if the network control is requested via bit 5 of the AC drive control word 0x400B:001. Otherwise FALSE. Notes: • Set this selection if the network control is to be activated via bit 5 of the AC drive control word. • The AC drive control word can be used with any communication protocol. ▸ AC drive control word 📖 302

▸ Example: Changeover to network control 📖 72

Notes:

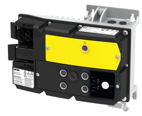
In case of an activated **network control**, the "Enable inverter" 0x2631:002 function must be set to "TRUE" to start the motor in addition to the "Run", either via digital input or by the "Constant TRUE [1]" setting.

In case of an activated **network control**, the following functions are still active:

- 0x2631:001: Enable inverter
- 0x2631:002: Run
- 0x2631:003: Activate quick stop
- 0x2631:004: Reset error
- 0x2631:005: DC braking
- 0x2631:010: Jog forward (CW)
- 0x2631:011: Jog reverse (CCW)*
- 0x2631:037: Activate network control*
- 0x2631:043: Activate error 1
- 0x2631:044: Activate error 2

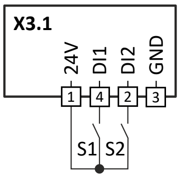
(*Not active in case of network operation in CiA402 mode 0x6060=2).

All other functions configurable via 0x2631:xxx are deactivated in case of network control.

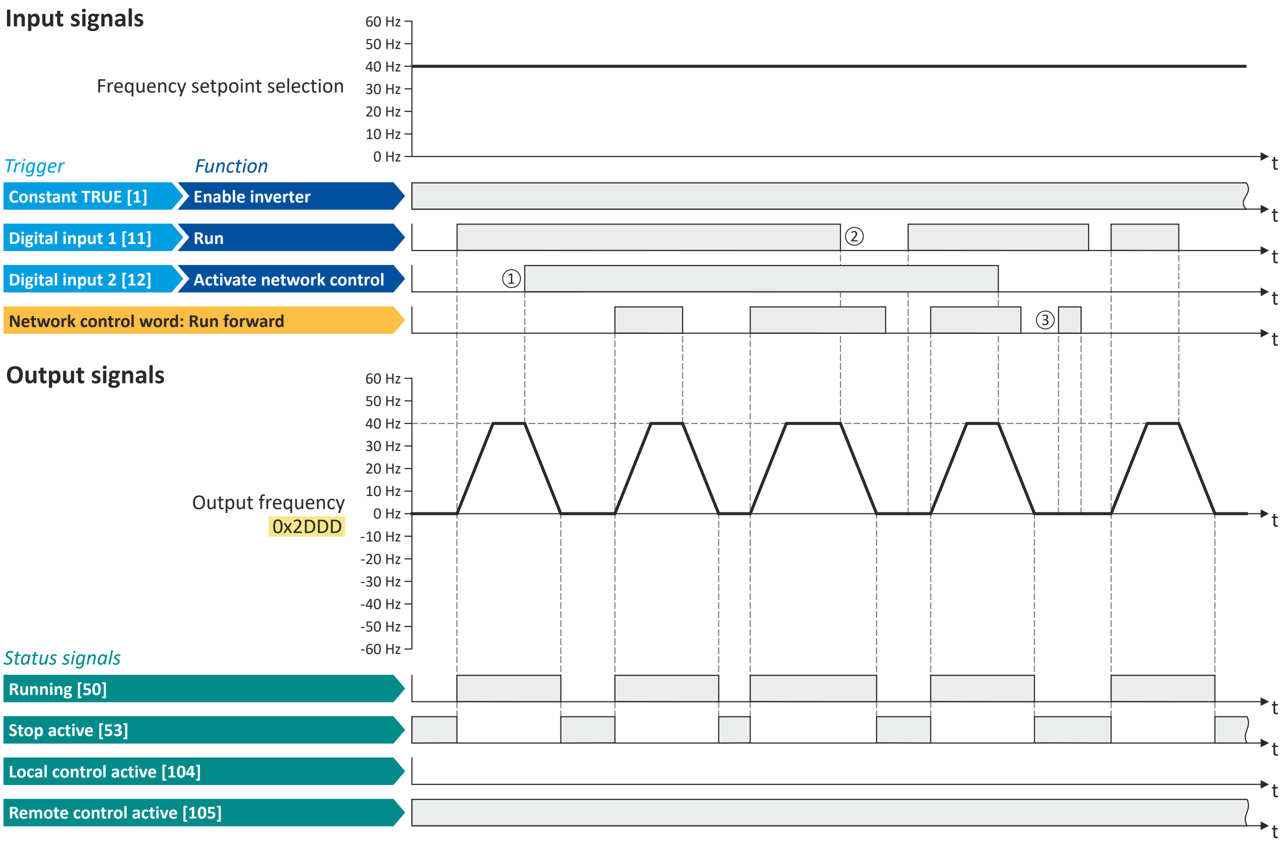


6.4.1 Example: Changeover to network control

- The control is executed primarily via the control connections. The switch S1 serves to start and stop the motor.
- The network control can be activated via the S2 switch. When network control is activated, the motor can only be started via the network control word. However, the condition is that the switch S1 is closed.
- If the switch S1 is opened again, the motor is stopped (irrespective of the active control source).

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Activate network control

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:037	Activate network control	Digital input 2 [12]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz



The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① When changing over to another control source, the motor is first stopped with the stop method set in 0x2838:003.
② The motor will also be stopped if the "Run" function is deactivated (irrespective of the active control source).
③ Commands via the network are ignored if the network control is not active.

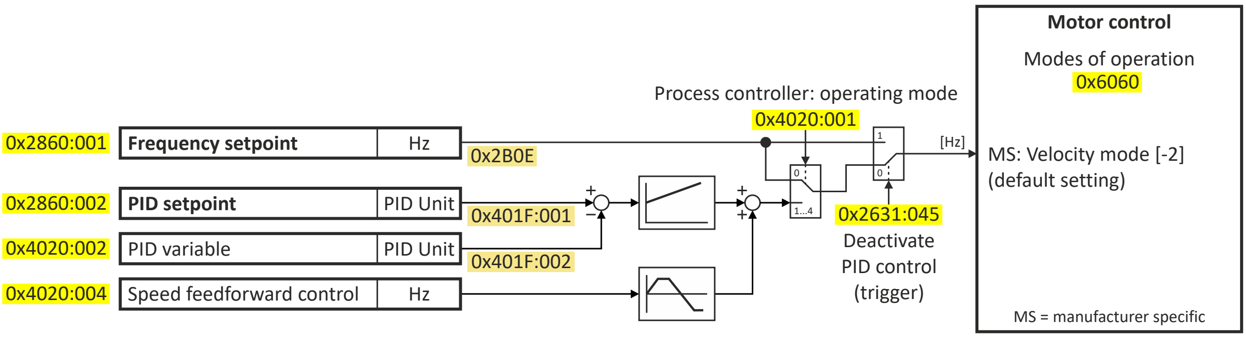
7 Configuring the frequency control

7.1 Basic setting

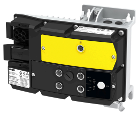
In the following, the steps required for configuring the frequency control are described.

1. Set 0x6060 to "MS: Velocity mode [-2]" operating mode (default setting).
2. Select the standard setpoint source for the frequency control in 0x2860:001.
3. Configure the selected standard setpoint source. ▸ Configure setpoint sources 📖 77
4. Adjust the ramp times to the application. ▸ Ramp times 📖 76
5. Optional: Configuring the process controller 📖 80

The following signal flow shows the internal setpoint logics:



The frequency control is now active and the inverter responds to the frequency setpoint given by the selected setpoint source.



7.1.1 Standard setpoint source

The selected "setpoint source" serves to provide the inverter with its setpoint. The setpoint source can be selected individually for each operating mode.

Possible setpoint sources:

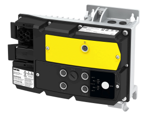
- Parameterizable setpoints (presets)
- Network
- IO-Link ports
- "Motor potentiometer" function
- "Analog signal scaling" function

Details

- For applications only requiring one setpoint, it is sufficient to define the standard setpoint source in 0x2860:001.
- For applications requiring a change-over of the setpoint source during operation, the functions for setpoint change-over have to be configured accordingly. ▸ Changing the setpoint source during operation 📖 92

Parameter

Address	Name / setting range / [default setting]		Information
0x2860:001	Frequency control: Default setpoint source		Selection of the standard setpoint source for operating mode "MS: Velocity mode". • The selected standard setpoint source is always active in the operating mode 0x6060 = "MS: Velocity mode [-2]" when no setpoint change-over to another setpoint source via corresponding triggers/ functions is active. ▸ Changing the setpoint source during operation 🕮 92
	5	Network	The setpoint is defined as process data object via the network. ▸ Define setpoint via network 🕮 271
	11	**Frequency preset 1**	For the setpoint selection, preset values can be parameterised and selected. ▸ Setpoint presets 🕮 77
	12	Frequency preset 2	
	13	Frequency preset 3	
	14	Frequency preset 4	
	15	Frequency preset 5	
	16	Frequency preset 6	
	17	Frequency preset 7	
	18	Frequency preset 8	
	19	Frequency preset 9	
	20	Frequency preset 10	
	21	Frequency preset 11	
	22	Frequency preset 12	
	23	Frequency preset 13	
	24	Frequency preset 14	
	25	Frequency preset 15	
	50	Motor potentiometer	The setpoint is generated by the "motor potentiometer" function. This function can be used as an alternative setpoint control which is controlled via two signals: "MOP setpoint up" and "MOP setpoint down". ▸ Motor potentiometer (MOP) 🕮 78
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 🕮 188 ▸ Configure IO-Link ports 🕮 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 🕮 406
	231	Scaling2 value	



7.1.2 Ramp times

The frequency setpoint is internally guided via a ramp generator. The acceleration time and the deceleration time are independently adjustable.

Details

- The acceleration time set in 0x291D:001 refers to an acceleration from standstill to the maximum frequency set in 0x2916. At a low setpoint selection, the real acceleration time decreases accordingly.
- The set deceleration time set in 0x291D:002 refers to the period of deceleration from the set maximum frequency to standstill. In the case of a lower actual frequency, the actual deceleration time is reduced accordingly.

Parameter

Address	Name / setting range / [default setting]	Information
0x291C	Quick stop deceleration time 0.0 ... [**1.0**] ... 3600.0 s	Quick stop deceleration time for the operating mode "MS: Velocity mode". • If the "Quick stop" function is activated, the motor is brought to a standstill within the deceleration time set here. • The deceleration time set refers to the deceleration from the maximum frequency set to standstill. In the case of a lower actual frequency, the actual deceleration time is reduced accordingly. • Setting is not effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]". ▸ Example: Quick stop 65
0x291D:001	Ramp times: Acceleration time 1 0.00 ... [**5.00**] ... 655.35 s	Acceleration time 1 for the operating mode "MS: Velocity mode". • The acceleration time set refers to the acceleration from standstill to the maximum frequency set. In the case of a lower setpoint selection, the actual acceleration time is reduced accordingly. • Setting is not effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]".
0x291D:002	Ramp times: Deceleration time 1 0.00 ... [**5.00**] ... 655.35 s	Deceleration time 1 for the operating mode "MS: Velocity mode". • The deceleration time set refers to the deceleration from the maximum frequency set to standstill. In the case of a lower actual frequency, the actual deceleration time is reduced accordingly. • Setting is not effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]".
0x291E:001	S-Ramp characteristic: Smoothing factor 0.0 ... [**0.0**] ... 100.0 %	Factor for S-rounding of the acceleration/deceleration ramps. • With the setting "0.0", the S-rounding is deactivated and acceleration/deceleration with linear ramps is carried out. • The smoothing factor increases the ramp time as follows: 50 % --> 1.5 x configured ramp time 100 % --> 2 x configured ramp time
0x291E:002	S-Ramp characteristic: Target window 0.0 ... [**1.0**] ... 599.0 Hz	

7.2 Configure setpoint sources

The following setpoint sources are described in this chapter:

- Setpoint presets 📖 77
- Motor potentiometer (MOP) 📖 78

Other setpoint source descriptions can be found here:

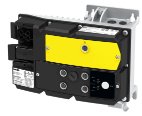
- Network: Define setpoint via network 📖 271
- IO-Link ports: Configure IO-Link ports 📖 205
- Function "Analog signal scaling" 📖 406

7.2.1 Setpoint presets

15 different frequency setpoints (presets) can be parameterised for the frequency control. 8 process controller setpoints (presets) can also be parameterised for the optional PID control.

Parameter

Address	Name / setting range / [default setting]	Information
0x2911:001	Frequency setpoint presets: Preset 1 0.0 ... [**20.0**] ... 1000.0 Hz	Parameterisable frequency setpoints (presets) for operating mode "MS: Velocity mode".
0x2911:002	Frequency setpoint presets: Preset 2 0.0 ... [**40.0**] ... 1000.0 Hz	
0x2911:003	Frequency setpoint presets: Preset 3 0.0 ... [**50.0**] ... 1000.0 Hz	
0x2911:004	Frequency setpoint presets: Preset 4 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:005	Frequency setpoint presets: Preset 5 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:006	Frequency setpoint presets: Preset 6 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:007	Frequency setpoint presets: Preset 7 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:008	Frequency setpoint presets: Preset 8 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:009	Frequency setpoint presets: Preset 9 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:010	Frequency setpoint presets: Preset 10 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:011	Frequency setpoint presets: Preset 11 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:012	Frequency setpoint presets: Preset 12 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:013	Frequency setpoint presets: Preset 13 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:014	Frequency setpoint presets: Preset 14 0.0 ... [**0.0**] ... 1000.0 Hz	
0x2911:015	Frequency setpoint presets: Preset 15 0.0 ... [**0.0**] ... 1000.0 Hz	



Address	Name / setting range / [default setting]	Information
0x4022:001	PID setpoint presets: Preset 1 -300.00 ... [**0.00**] ... 300.00 PID unit	Parameterisable process controller setpoints (presets) for PID control.
0x4022:002	PID setpoint presets: Preset 2 -300.00 ... [**0.00**] ... 300.00 PID unit	
0x4022:003	PID setpoint presets: Preset 3 -300.00 ... [**0.00**] ... 300.00 PID unit	
0x4022:004	PID setpoint presets: Preset 4 -300.00 ... [**0.00**] ... 300.00 PID unit	
0x4022:005	PID setpoint presets: Preset 5 -300.00 ... [**0.00**] ... 300.00 PID unit	
0x4022:006	PID setpoint presets: Preset 6 -300.00 ... [**0.00**] ... 300.00 PID unit	
0x4022:007	PID setpoint presets: Preset 7 -300.00 ... [**0.00**] ... 300.00 PID unit	
0x4022:008	PID setpoint presets: Preset 8 -300.00 ... [**0.00**] ... 300.00 PID unit	

A switch-over to a preset during operation is also possible as an alternative to the standard setpoint source setting.

7.2.2 Motor potentiometer (MOP)

The "Motor potentiometer" function can be used as an alternative setpoint control that is controlled via two functions: "MOP setpoint up" and "MOP setpoint down".

Details

If the motor potentiometer is active as the setpoint source, the setpoint generated by this function ("MOP value") can be changed according to following the truth table via the triggers assigned to the two functions "MOP setpoint up" and "MOP setpoint down":

MOP setpoint up 0x2631:023	MOP setpoint down 0x2631:024	Response of the function
FALSE	FALSE	The last MOP value is maintained.
TRUE	FALSE	The MOP value is increased to a maximum of the upper limit value for the respective operating mode with the acceleration time 2. (The motor follows the setpoint change with acceleration time 1.)
FALSE	TRUE	The MOP value is increased to a maximum of the lower limit value for the respective operating mode with the deceleration time 2. (The motor follows the setpoint change with deceleration time 1.)
TRUE	TRUE	The last MOP value is maintained.

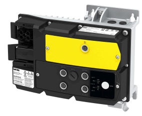
The start behavior can be selected in 0x4003. In the default setting, the last MOP value is used as the initial value. The last MOP value remains available after switching the mains voltage off and on again. As an alternative, an adjustable initial value or the minimum value can be used for starting.

Parameter

Address	Name / setting range / [default setting]	Information
0x2631:023	Function list: MOP setpoint up • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "MOP setpoint up" function. Trigger = TRUE: setpoint generated by the "Motor potentiometer" function ("MOP value") is maximally increased to the upper range limit with acceleration time 2. Trigger = FALSE: last MOP value is maintained. Notes: • If the "MOP setpoint up" and "MOP setpoint down" functions are active at the same time, the last MOP value is maintained. • Acceleration time 2 can be set in 0x291D:003.
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).

Address	Name / setting range / [default setting]	Information
0x2631:024	Function list: MOP setpoint down • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "MOP setpoint down" function. Trigger = TRUE: setpoint generated by the "Motor potentiometer" function ("MOP value") is maximally decreased to the lower range limit with deceleration time 2. Trigger = FALSE: last MOP value is maintained. Notes: • If the "MOP setpoint up" and "MOP setpoint down" functions are active at the same time, the last MOP value is maintained. • Deceleration time 2 can be set in 0x291D:004.
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x4003	MOP starting mode	Selection of the initial value which is used after activation of the function.
	0 **Last value**	The last MOP value is used as initial value. It is still provided after the mains voltage has been switched off and on again. Note: The last MOP value is saved in the internal EEPROM of the inverter. If the memory module is transferred to a compatible device, the last MOP value will therefore not be accepted.
	1 Starting value	The starting value of the corresponding operating mode is used as initial value: • 0x4004:001 for the operating mode "MS: Velocity mode" • 0x4004:002 for PID control • 0x4004:003 for the operating mode "MS: Torque mode"
	2 Minimum value	The minimum value of the corresponding operating mode is used as initial value: • 0x2915 for the operating mode "MS: Velocity mode" • 0x404E:001 for PID control
0x4004:001	MOP starting values: Frequency 0.0 ... [**0.0**] ... 1000.0 Hz	Starting value for operating mode "MS: Velocity mode". • This value is used as initial value if "Starting value [1]" is set in 0x4003.
0x4004:002	MOP starting values: PID value -30.00 ... [**0.00**] ... 30.00 PID unit	Starting value for reference value of the PID control. • This value is used as initial value if "Starting value [1]" is set in 0x4003.
0x4004:003	MOP starting values: Torque 0.0 ... [**0.0**] ... 1000.0 %	Starting value for operating mode "MS: Torque mode". • This value is used as initial value if "Starting value [1]" is set in 0x4003. • 100 % = motor rated torque (0x6076).
0x4009:001	MOP values saved: Frequency • Read only: x.x Hz	Display of the last MOP value saved internally for the operating mode "MS: Velocity mode". • This value is used as initial value if "Last value [0]" is set in 0x4003.
0x4009:002	MOP values saved: PID value • Read only: x.xx PID unit	Display of the last MOP value saved internally for the reference value of the PID control. • This value is used as initial value if "Last value [0]" is set in 0x4003.
0x4009:003	MOP values saved: Torque • Read only: x.x %	Display of the last MOP value saved internally for the operating mode "MS: Torque mode". • This value is used as initial value if "Last value [0]" is set in 0x4003. • 100 % = motor rated torque (0x6076).

A switch-over to the motor potentiometer during operation is also possible as an alternative to the standard setpoint source setting.



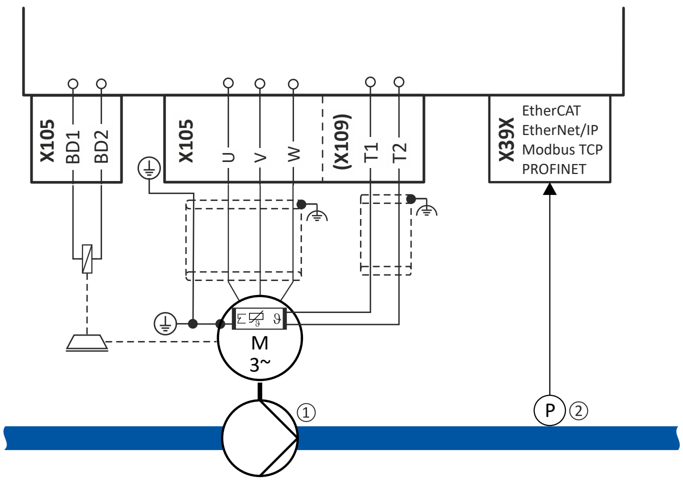
7.3 Configuring the process controller

By means of the process controller, a process variable can be regulated, for instance the pressure of a pump. The process controller is also referred to as "PID controller" (PID controller = proportional, integral and differential controller).

The process controller is part of a closed control loop. The variable to be influenced (controlled variable) is measured continuously by means of a sensor and supplied to the inverter as an analog signal (actual value) which, in the inverter, is then compared to the reference value (setpoint). The system deviation resulting therefrom is supplied to the process controller which, on this basis, decelerates or accelerates the motor speed according to the desired dynamic performance of the control loop, so that, for instance, a pump always generates the desired pressure.

Connection plan (example)

The following sample connection plan shows the control of a pump ①. The feedback of the variable (here: pressure) takes place via a pressure transducer ②. In this example, the inverter receives the process data of the pressure transducer via network.



The digital inputs can be used to activate functions of the process controller. The specific assignment of the digital inputs and type of the contacts (switches or buttons, normally-closed contacts or normally-open contacts) depends on the application.

General information on the setting

- First implement the basic setting of the frequency control. ▶ Basic setting 📖 73
- The basic setting of the process controller is described in the following subchapter.
  ▶ Basic setting 📖 81

Functions in preparation:

- Optionally, the motor can be put into an energy-saving sleep mode if no power is required.
  ▶ Process controller sleep mode 📖 87
- The rinse function which can be activated in addition accelerates the motor in sleep mode to a defined speed at regular intervals. The rinsing of a pipe system with a pump that has been in an inactive state for a longer period is a typical application. ▶ Process controller rinse function 📖 87

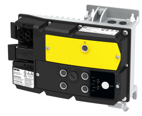
7.3.1 Basic setting

The process controller is set in two steps:
1. Basic settings
2. Fine adjustment of the PID controller for an optimum control mode

Basic settings

Based on the default setting, we recommend the following proceeding:
1. Select the standard setpoint source for the frequency control in 0x2860:001.
2. Configure the selected standard setpoint source. ▶ Configure setpoint sources 📖 77
3. Activate the PID control. Set the desired operating mode (normal or reverse operation) in 0x4020:001.
4. Select the source for the feedback of the controlled variable in 0x4020:002.
5. If a (temporary) change-over to a speed-controlled operation is to be possible via a digital input:
   - Assign a free digital input to the control function "Disable PID controller" in 0x2631:045. As long as the digital input provides a TRUE signal, the PID control is ignored and the motor is driven in a speed-controlled way.
   - Set acceleration time 0x4021:001 and deceleration time 0x4021:002 for speed-controlled drive control.
6. Select the standard setpoint source for the reference value in 0x2860:002.
   - Functions for setpoint change-over can be used as well. ▶ Changing the setpoint source during operation 📖 92
   - If process controller presets are used, they have to be set in 0x4022:001 ... 0x4022:008.
7. Set the speed range to be controlled in 0x4020:003.
8. If the output value of the process controller is to be limited, adapt the following parameters:
   - 0x4020:005: Min speed limit
   - 0x4020:006: Max speed limit
9. Test the following parameters with the default setting first and only adapt them if required:
   - 0x404B: Setpoint ramp
   - 0x404C:001: Acceleration time for showing the process controller influence
   - 0x404C:002: Deceleration time for hiding the process controller influence
10. Diagnostics: check the current reference value and feedback of the control variable:
    - The current reference value (setpoint) is displayed in 0x401F:001.
    - The current variable (actual value) is displayed in 0x401F:002.

After the basic setting of the process controller has been carried out, a fine adjustment of the PID controller must be executed for optimum control behavior (see the following section).



Fine adjustment of the PID controller

The dynamics of the PID controller are parameterized based on the gain of the P component 0x4048, the reset time for the I component 0x4049 and the gain of the D component 0x404A. In the default setting, the process controller operates as a PI controller. The D component is deactivated.

Basics

- If only the P component is used and the system operates in a steady-state status (the reference value is constant and the process variable is controlled to a fixed value), a certain system deviation always continues to exist. This remaining system deviation is also called "stationary deviation".
- The I component prevents a permanent fluctuation around the setpoint. Here, the reset time 0x4049 determines how much the duration of the control deviation influences the control. A high reset time means a lower influence of the I component and vice versa.
- The D component does not respond to the height of the system deviation but to their rate of change only. The D component acts as a "damper" for overshoots. Overshoots may occur if the control tries to respond quickly to changes in the system deviation or the reference value. Thus, the D component reduces the risk of instabilities due to overshoots.

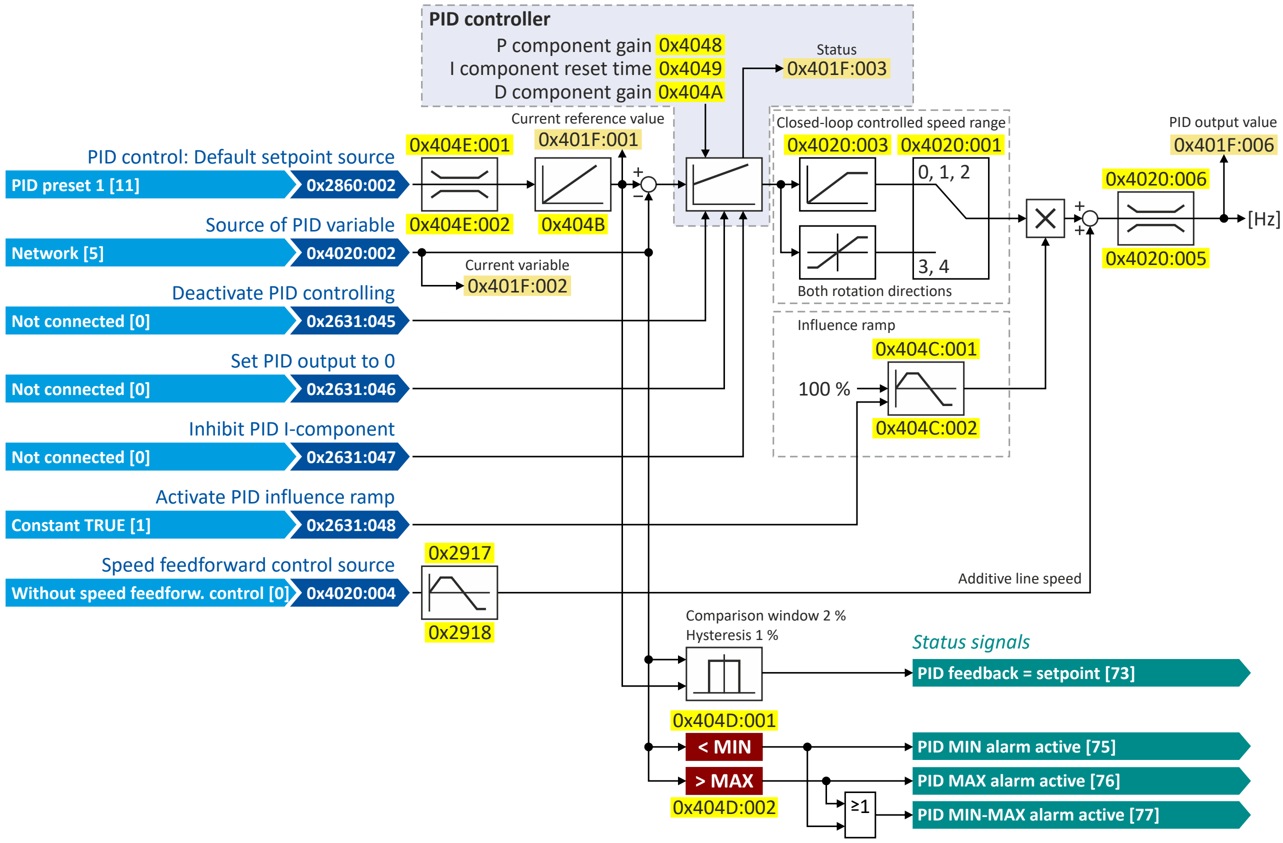
For most applications, the setting of the gain of the P component and the reset time for the I component is sufficient for the fine adjustment. The setting of the gain of the D component may by required for a further stabilization of the system especially if a quick response to system deviations is to take place.

Execute fine adjustment:

1. Set the reset time for the I component to 6000 ms in 0x4049 to deactivate the I component.
   - With this setting and the default setting of 0x404A, the process controller operates as P controller.
2. Increase gain of the P component step by step in 0x4048 until the system becomes instable.
3. Reduce the gain again until the system is stable again.
4. Reduce the gain by another 15 %.
5. Set reset time for the I component in 0x4049.
   - With this setting it should be noted that a too low reset time may cause overshoots, especially in case of high steps of the system deviation.
6. Optional: set the gain of the D component in 0x404A.
   - With this setting it should be noted that the D component responds very sensitively to electrical disturbance during the feedback as well as digitization errors.

Internal signal flow

The following illustration shows the internal signal flow of the process controller (without the additional functions "sleep mode" and "rinse function"):



Control functions

The flexible I/O configuration serves to configure different control functions for the process controller:

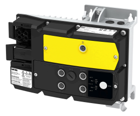
- 0x2631:045: Disable PID controller
- 0x2631:046: Set process controller output to 0
- 0x2631:047: Inhibit process controller I-component
- 0x2631:048: Activate PID influence ramp

For details see chapter "Process controller function selection". 88

Status signals for configurable outputs

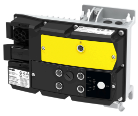
The process controller provides different internal status signals. These status signals can be assigned to the digital outputs or the NetWordOUT1 status word.

For details see chapter "Configure digital outputs". 194

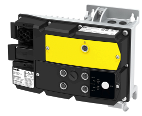


Parameter

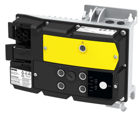
Address	Name / setting range / [default setting]		Information
0x2860:002	PID control: Default setpoint source		Selection of the standard setpoint source for the reference value of the PID control. • The selected standard setpoint source is always active with an activated PID control when no setpoint change-over to another setpoint source via corresponding triggers/functions is active.
	5	Network	The setpoint is defined as process data object via the network. ▸ Define setpoint via network 📖 271
	11	**PID preset 1**	For the setpoint selection, preset values can be parameterised and selected. ▸ Setpoint presets 📖 77
	12	PID preset 2	
	13	PID preset 3	
	14	PID preset 4	
	15	PID preset 5	
	16	PID preset 6	
	17	PID preset 7	
	18	PID preset 8	
	50	Motor potentiometer	The setpoint is generated by the "motor potentiometer" function. This function can be used as an alternative setpoint control which is controlled via two signals: "MOP setpoint up" and "MOP setpoint down". ▸ Motor potentiometer (MOP) 📖 78
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 📖 406
	231	Scaling2 value	
0x4020:001	Process controller setup (PID): Operating mode		Selection of the process controller operating mode.
	0	**Inhibited**	Process controller deactivated.
	1	Normal operation	The setpoint is higher than the feedback variable (actual value). If the system deviation increases, the motor speed is increased. Example: pressure-controlled booster pumps (increase in the motor speed produces an increase in pressure.)
	2	Reverse operation	The setpoint is lower than the feedback variable (actual value). If the system deviation increases, the motor speed is increased. Example: temperature-controlled cooling water pump (increase in motor speed produces decrease in temperature.)
	3	Normal bi-directional	The direction of rotation corresponds to the sign of the system deviation. If the system deviation increases, the motor speed is increased.
	4	Reverse bi-directional	A negative system deviation causes a positive direction of rotation. If the system deviation increases, the motor speed is increased.



Address	Name / setting range / [default setting]		Information
0x4020:002	Process controller setup (PID): PID process variable		Selection of the source via which the feedback of the controlled variable (actual value) for the process controller is effected.
	3	DC-bus voltage	
	4	Motor Current	
	5	**Network**	
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 📖 406
	231	Scaling2 value	
0x4020:003	Process controller setup (PID): Closed-loop controlled speed range 0 ... [**100**] ... 100 %		Setting of the maximum output frequency up to which the process controller carries out regulation. • 100 % = Maximum frequency 0x2916.
0x4020:004	Process controller setup (PID): Speed feedforward control source		Optional selection of a speed feedforward control source for the process controller. • Is advisable, for instance, for dancer position controls if the motor speed must not fall below line speed (process controller output value = line speed + controlled motor speed). • Standard applications usually do not require a speed feedforward control; therefore it is deactivated in the default setting.
	0	**Without speed addition**	
	4	Frequency preset 1	
	5	Frequency preset 2	
	6	Frequency preset 3	
	7	Frequency preset 4	
	8	Network	
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 📖 406
	231	Scaling2 value	
0x4020:005	Process controller setup (PID): Min speed limit -100.0 ... [**-100.0**] ... 100.0 %		Configuration of the process controller • 100 % = Maximum frequency 0x2916. • The limitation becomes effective after the line speed has been added. • The value set here also limits the I component of the PID controller (Integrator-Anti-Windup).
0x4020:006	Process controller setup (PID): Max speed limit -100.0 ... [**100.0**] ... 100.0 %		Maximum output value of the process controller. • 100 % = Maximum frequency 0x2916. • The limitation becomes effective after the line speed has been added. • The value set here also limits the I component of the PID controller (Integrator-Anti-Windup).
0x4021:001	PID speed operation: Acceleration time 0.0 ... [**1.0**] ... 3600.0 s		Acceleration time for (temporary) speed-controlled drive control in process controller mode. • The acceleration time takes effect at the output of the process controller.
0x4021:002	PID speed operation: Deceleration time 0.0 ... [**1.0**] ... 3600.0 s		Deceleration time for (temporary) speed-controlled drive control in process controller mode. • The deceleration time takes effect at the output of the process controller. • **Exception:** In case of quick stop, the quick stop delay time is effective.



Address	Name / setting range / [default setting]	Information
0x4048	PID P-component 0.0 ... [**5.0**] ... 1000.0 %	Output frequency of the process controller per 1 % system deviation. • 100 % = maximum frequency 0x2916.
0x4049	PID I- component 0 ... [**400**] ... 6000 ms	Reset time for system deviation. • With the setting "6000 ms", the I component is deactivated. • The I component can also be deactivated via the "Inhibit process controller I-component" 0x2631:047 function.
0x404A	PID D-component 0.0 ... [**0.0**] ... 20.0 s	D component, does not respond to the rate of the system deviation, but only to its rate of change.
0x404B	PID setpoint ramp 0.0 ... [**20.0**] ... 100.0 s	Acceleration time and deceleration time for the process controller setpoint, relating to 100 PID units Example: A setpoint increase from 0 PID units to 100 PID units with the default ramp takes 20s.
0x404C:001	PID influence: Acceleration time for activation 0.0 ... [**5.0**] ... 999.9 s	If the trigger assigned in 0x2631:048 of the "Activate PID influence ramp" function is TRUE, the influence of the process controller is shown by means of a ramp with the acceleration time set here.
0x404C:002	PID influence: Deceleration time for masking out 0.0 ... [**5.0**] ... 999.9 s	If the trigger assigned in 0x2631:048 of the "Activate PID influence ramp" function is FALSE, the influence of the process controller is hidden via a ramp with the deceleration time set here.
0x404C:003	PID influence: PID influence factor -200.0 ... [**100.0**] ... 200.0 %	
0x404D:001	PID alarms: MIN alarm threshold -300.00 ... [**0.00**] ... 300.00 PID unit	Trigger threshold for the status signal "PID MIN alarm active [75]". • The "PID MIN alarm active [75]" status signal is TRUE if the feedback variable (with activated PID control) is lower than the threshold set here. • The status signal can be assigned to the relay or to a digital output. ▶ Configure digital outputs 📖 194 • The status signal can be assigned to the NetWordOUT1 status word. ▶ Define your own status word format 📖 264
0x404D:002	PID alarms: MAX alarm threshold -300.00 ... [**100.00**] ... 300.00 PID unit	Trigger threshold for the status signal "PID MAX alarm active [76]". • The "PID MAX alarm active [76]" status signal is TRUE if the feedback variable (with activated PID control) is higher than the threshold set here. • The status signal can be assigned to the relay or to a digital output. ▶ Configure digital outputs 📖 194 • The status signal can be assigned to the NetWordOUT1 status word. ▶ Define your own status word format 📖 264
0x404D:003	PID alarms: Monitoring bandwidth PID feedback signal 0.00 ... [**2.00**] ... 100.00 PID unit	Hysteresis for status signal "PID feedback = setpoint [73]". • 100 % = configured variable input range • Example: Variable input range 0 ... 10 V: 2 % = 0.2 V • The status signal "PID feedback = setpoint [73]" is TRUE if the controlled variable feedback = process controller setpoint (± hysteresis set here). • The status signal can be assigned to the relay or to a digital output. ▶ Configure digital outputs 📖 194 • The status signal can be assigned to the NetWordOUT1 status word. ▶ Define your own status word format 📖 264
0x404E:001	PID setpoint limits: Minimum setpoint -300.00 ... [**-300.00**] ... 300.00 PID unit	Minimum value of the process controller setpoint.
0x404E:002	PID setpoint limits: Maximum setpoint -300.00 ... [**300.00**] ... 300.00 PID unit	Maximum value of the process controller setpoint.



7.3.2 Process controller sleep mode

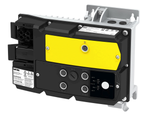
Parameter

Address	Name / setting range / [default setting]	Information
0x4023:001	PID sleep mode: Activation	Condition for activating the sleep mode.
	0 **Disabled**	Sleep mode deactivated.
	1 Output frequency < threshold	0x2B0E < 0x4023:003 (+ Delay time 0x4023:005)
	2 Output frequency < threshold OR process variable > feedback threshold	0x2B0E < 0x4023:003 (+ Delay time 0x4023:005) OR 0x401F:002 > 0x4023:004 (+ Delay time 0x4023:005)
	3 Output frequency < threshold OR process variable < feedback threshold	0x2B0E < 0x4023:003 (+ Delay time 0x4023:005) OR 0x401F:002 < 0x4023:004 (+ Delay time 0x4023:005)
0x4023:002	PID sleep mode: Stop method	Selection of the stop method after activation of the sleep mode.
	0 **Coasting**	The motor has no torque (coasts down to standstill).
	1 Deceleration to standstill	The motor is brought to a standstill with deceleration time 1 (or deceleration time 2, if activated). • Deceleration time 1 can be set in . • Deceleration time 2 can be set in . ▸ Ramp times 📖 76
	2 Stop method set	The stop method set in 0x2838:003 is used.
0x4023:003	PID sleep mode: Frequency threshold 0.0 ... [**0.0**] ... 1000.0 Hz	Frequency threshold for activating the sleep mode. • For comparing "output frequency < threshold" in case of selection 1 ... 3 in 0x4023:001.
0x4023:004	PID sleep mode: Feedback threshold -300.00 ... [**0.00**] ... 300.00 PID unit	Feedback threshold for activating the sleep mode. • For comparing "variable > feedback threshold" in case of selection 2 in 0x4023:001. • For comparing "variable < feedback threshold" in case of selection 3 in 0x4023:001.
0x4023:005	PID sleep mode: Delay time 0.0 ... [**0.0**] ... 300.0 s	Minimum time for which the respective threshold must be underrun or exceeded before the sleep mode is activated.
0x4023:006	PID sleep mode: Recovery	Condition for terminating the sleep mode.
	0 **Setpoint > threshold OR system deviation > bandwidth**	0x2B0E > 0x4023:003 (+ 2 Hz hysteresis) OR 0x401F:007>0x4023:007
	1 Process variable < recovery threshold	0x401F:002 < 0x4023:008
	2 Process variable > recovery threshold	0x401F:002>0x4023:008
0x4023:007	PID sleep mode: Bandwidth 0.00 ... [**0.00**] ... 300.00 PID unit	Range around the process controller setpoint for ending the sleep mode. • 0.00 = bandwidth deactivated.
0x4023:008	PID sleep mode: Recovery threshold -300.00 ... [**0.00**] ... 300.00 PID unit	Termination threshold for sleep mode.

7.3.3 Process controller rinse function

Parameter

Address	Name / setting range / [default setting]	Information
0x4024:001	Automatic rinsing: Rinsing in sleep mode	1 = activate automatic rinsing in sleep mode.
	0 **Inhibited**	
	1 Enabled	
0x4024:002	Automatic rinsing: Rinse interval 0.0 ... [**30.0**] ... 6553.5 min	Time interval between two rinsing processes.
0x4024:003	Automatic rinsing: Rinse speed -1000.0 ... [**0.0**] ... 1000.0 Hz	Speed setpoint for rinse function.
0x4024:004	Automatic rinsing: Rinse period 0.0 ... [**0.0**] ... 6553.5 s	Duration of a rinsing process.



7.3.4 Process controller function selection

By means of the following functions, the response of the inverter can be controlled when PID control is activated.

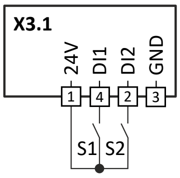
Parameter

Address	Name / setting range / [default setting]	Information
0x2631:045	Function list: Disable PID controller • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Disable PID controller" function. Trigger = TRUE: If PID control is activated, ignore PID control and drive the motor in speed-controlled manner. Trigger = FALSE: If PID control is activated, drive the motor with PID control. Notes: • The PID control mode can be selected in 0x4020:001.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2631:046	Function list: Set process controller output to 0 • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Set process controller output to 0" function. Trigger = TRUE: If PID control is activated, I component and the output of the PID controller are set to 0 and the internal control algorithm is stopped. The PID control remains active. Trigger = FALSE: no action / deactivate function again.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2631:047	Function list: Inhibit process controller I-component • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Inhibit process controller I-component" function. Trigger = TRUE: If PID control is activated, the I component of the PID controller is set to 0 and the integration process is stopped. Trigger = FALSE: no action / deactivate function again. Notes: • The reset time can be set in 0x4049.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2631:048	Function list: Activate PID influence ramp • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate PID influence ramp" function. Trigger = TRUE: the influence of the process controller is shown via a ramp. Trigger = FALSE or not connected: the influence of the process controller is hidden via ramp. Notes: • The influence of the process controller is always active (not only when PID control is activated). • Acceleration time for showing the influence of the process controller can be set in 0x404C:001. • Deceleration time for hiding the influence of the process controller can be set in 0x404C:002.
	1 Constant TRUE	Trigger is constantly TRUE.

Example for operating mode

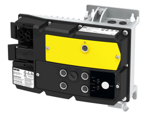
In the following example, the "Disable PID controller" function is used to deactivate the PID control temporarily:

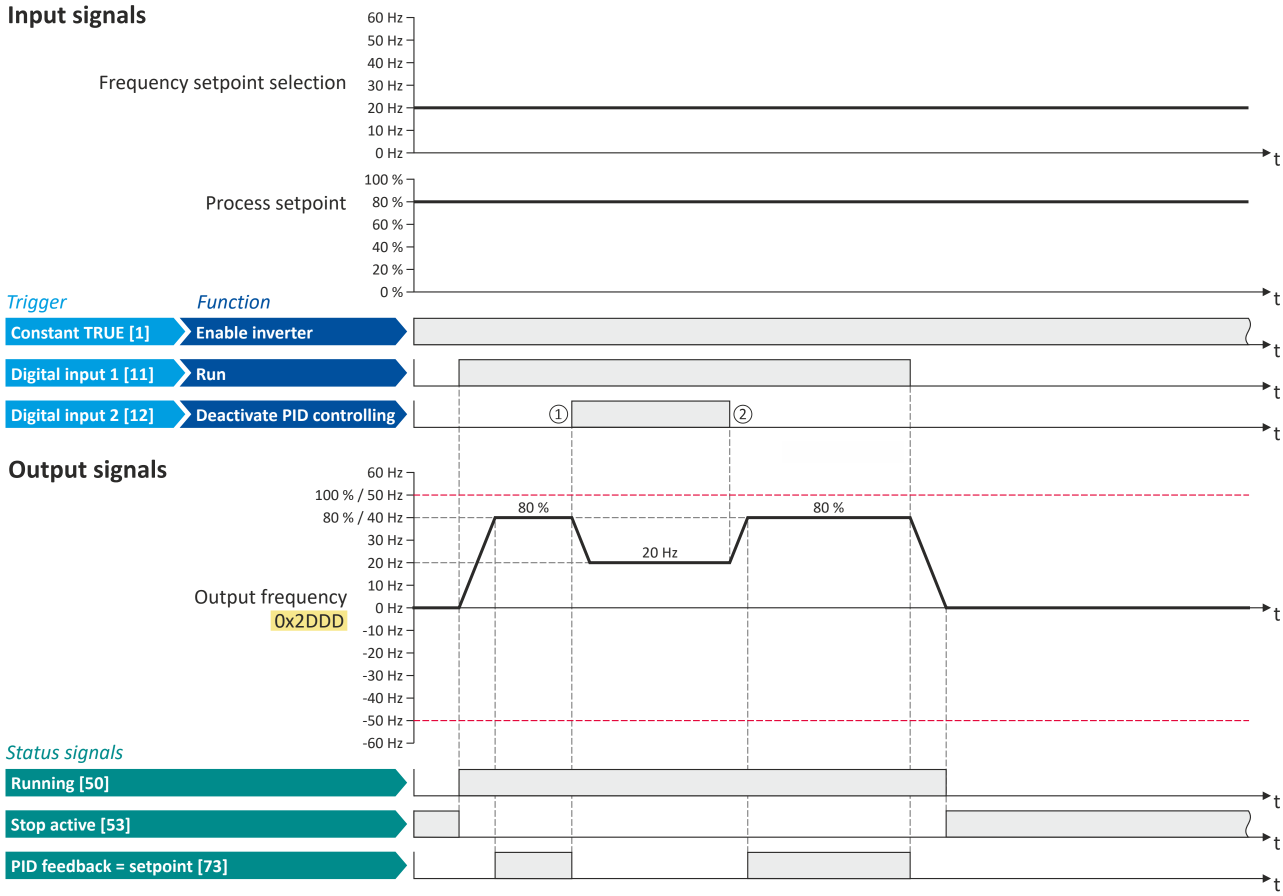
- As standard setpoint source, the frequency preset 1 is set to 20 Hz.
- Switch S1 starts the motor in the forward direction of rotation. Switch S1 in initial position stops the motor again.
- The switch S2 deactivates the PID control. The motor is then operated speed-controlled.

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Disable PID controller

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:045	Disable PID controller	Digital input 2 [12]
0x2838:003	Stop method	Standard ramp [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 1 [11]
0x2911:001	Frequency setpoint presets: Preset 1	20 Hz
0x2916	Maximum frequency	50 Hz

The example assumes that the process controller has been configured accordingly.
▶ Basic setting 📖 81





The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① PID control is deactivated: a changeover is initiated from the configured PID control to speed-controlled operation.

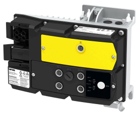
② PID control is activated again: a changeover is initiated from speed-controlled operation back to the configured PID control.

7.3.5 Process controller diagnostics

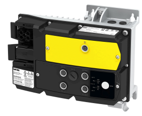
The following parameters serve to diagnose the process controller.

Parameter

Address	Name / setting range / [default setting]	Information
0x401F:001	Process controller diagnostics: Current setpoint • Read only: x.xx PID unit	Display of the current reference value (setpoint) for the process controller.
0x401F:002	Process controller diagnostics: Current process variable • Read only: x.xx PID unit	Display of the current controlled feedback variable (actual value) for the process controller.
0x401F:003	Process controller diagnostics: Status • Read only	Bit-coded status display of the process controller.
	Bit 0 Process controller off	
	Bit 1 PID output set to 0	
	Bit 2 PID I-component inhibited	
	Bit 3 PID influence active	
	Bit 4 Setpoint = actual value	
	Bit 5 Sleep mode active	
	Bit 6 Max. alarm	
	Bit 7 Min. alarm	
0x401F:004	Process controller diagnostics: PID control value • Read only: x.x Hz	Display of the output frequency after the PID controller, but without any influencing factor.
0x401F:005	Process controller diagnostics: PID Feedforward value • Read only: x.x Hz	Display of the feedforward control value for the process controller.



Address	Name / setting range / [default setting]	Information
0x401F:006	Process controller diagnostics: PID output value • Read only: x.x Hz	Display of the current process controller setpoint that is internally transferred to the motor control (considering the feedforward control value).
0x401F:007	Process controller diagnostics: PID error value • Read only: x.xx PID unit	Display of the difference between reference value (setpoint) and feedback variable (actual value) of the process controller.



7.4 Changing the setpoint source during operation

The inverter receives its setpoint from the selected standard setpoint source. For applications requiring a change-over of the setpoint source during operation, the functions listed below must be configured.

Details

If the network control is activated, the functions for the setpoint changeover are not active! If network control is in operation but no setpoint is defined via the network control word, the standard setpoint source is active.

Function	Information
Activate network setpoint 0x2631:017	Activate network as setpoint source. ▸ Define setpoint via network 📖 271
Activate preset (bit 0) 0x2631:018	Activate parameterizable setpoints (presets) as setpoint source. • 15 frequency setpoints and 8 PID setpoints can be set as presets. • A preset can be selected binary-coded via the four functions "Activate preset (bit 0)" ... "Activate preset (bit 3)". ▸ Setpoint presets 📖 77
Activate preset (bit 1) 0x2631:019	
Activate preset (bit 2) 0x2631:020	
Activate preset (bit 3) 0x2631:021	

Diagnostic parameters:

- 0x282B:002: Active setpoint source

Priority of the setpoint sources

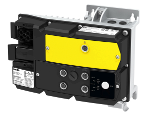
Since only one setpoint source can be active at a time, the following priorities apply:

Flexible I/O configuration active 0x2631:037 = FALSE	Network control active 0x2631:037 = TRUE
Prio 1: Functions for setpoint changeover The priority of the functions results from the assigned triggers (in the order of the selection list): 1. Constant TRUE [1] 2. Digital input 1 [11] 3. Digital input 2 [12] 4. Digital input 3 [13] 5. ...	Prio 1: Setpoint source selected via network control word ▸ Control the inverter via network 📖 255
Prio 2: Standard setpoint source set in 0x2860:001	Prio 2: Standard setpoint source set in 0x2860:001

Parameter

Address	Name / setting range / [default setting]		Information
0x2631:017	Function list: Activate network setpoint • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Activate network setpoint" function. Trigger = TRUE: the network is used as setpoint source (if the trigger assigned has the highest setpoint priority). Trigger = FALSE: no action / deactivate function again.
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
	116	Network setpoint active	TRUE if a change-over to network setpoint is requested via bit 6 of the AC drive control word 0x400B:001. Otherwise FALSE. Notes: • This setting is used if bit 6 of the AC drive control word is to be used independently of bit 5 AC drive control word. • The AC drive control word can be used with any communication protocol. ▸ AC drive control word 📖 302

Address	Name / setting range / [default setting]	Information
0x2631:018	Function list: Activate preset (bit 0) • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate preset (bit 0)" function. The bit with the valency 2^0 for bit-coded selection and the activation of a parameterised setpoint (preset). Trigger = FALSE: bit = "0". Trigger = TRUE: bit = "1".
	14 **Digital input 4**	State of X3/DI4, taking an inversion set in 0x2632:004 into consideration.
0x2631:019	Function list: Activate preset (bit 1) • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate preset (bit 1)" function. The bit with the valency 2^1 for bit-coded selection and the activation of a parameterised setpoint (preset). Trigger = FALSE: bit = "0". Trigger = TRUE: bit = "1".
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:020	Function list: Activate preset (bit 2) • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate preset (bit 2)" function. The bit with the valency 2^2 for bit-coded selection and the activation of a parameterised setpoint (preset). Trigger = FALSE: bit = "0". Trigger = TRUE: bit = "1".
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:021	Function list: Activate preset (bit 3) • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate preset (bit 3)" function. Selection bit with the valency 2^3 for the bit-coded selection and activation of a parameterised setpoint (preset value). Trigger = FALSE: selection bit = "0". Trigger = TRUE: selection bit = "1".
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:025	Function list: Activate MOP setpoint • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Activate MOP setpoint" function. Trigger = TRUE: the "Motor potentiometer" function is used as setpoint source (if the trigger assigned has the highest setpoint priority). Trigger = FALSE: no action / deactivate function again.
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).



7.5 Change over to ramp 2 during operation

Two different ramps can be parameterised for the frequency setpoint. The change-over to the ramp 2 can be initiated manually or automatically.

Details

For ramp 2, the acceleration time 2 set in 0x291D:003 and the deceleration time 2 set in 0x291D:004 apply.

The change-over to ramp 2 is effected automatically if the frequency setpoint (absolute value) ≥ auto-changeover threshold 0x291B.

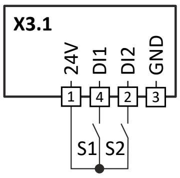
The "Activate ramp 2" 0x2631:039 function serves to manually activate the acceleration time 2 and the deceleration time 2.

Parameter

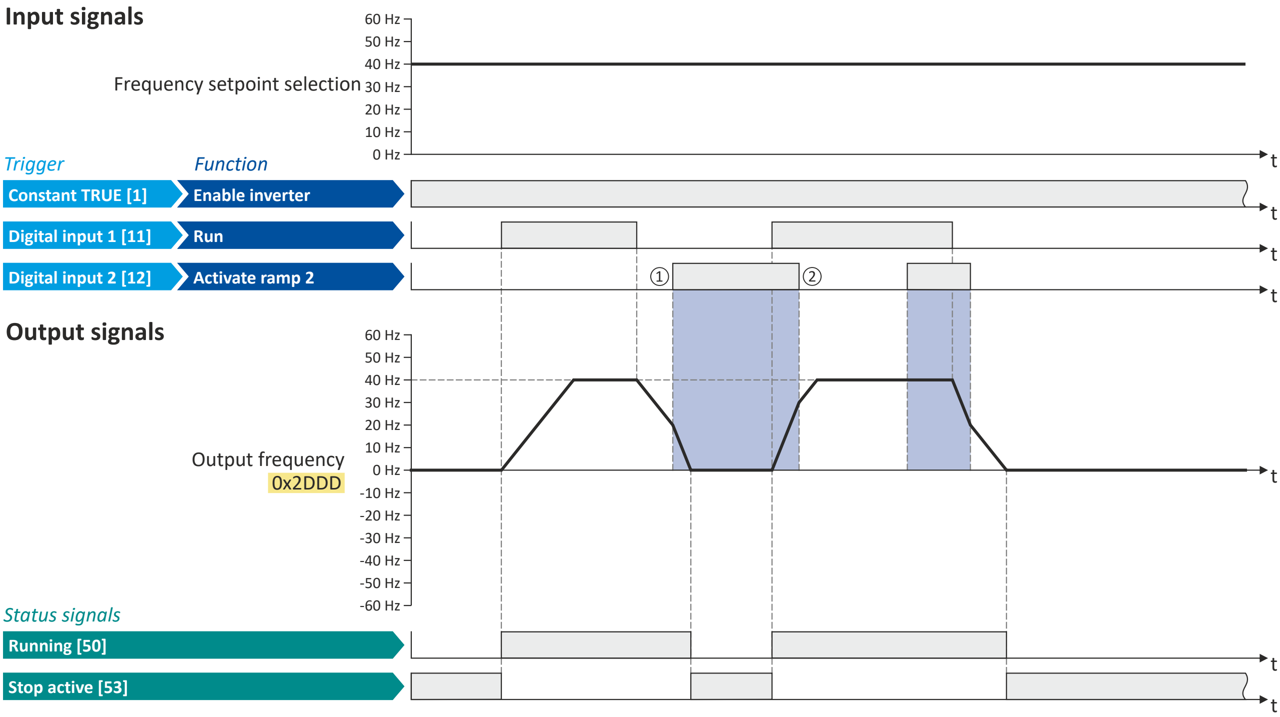
Address	Name / setting range / [default setting]	Information
0x291B	Auto-changeover threshold of ramp 2 0.0 ... [**0.0**] ... 599.0 Hz	Threshold for the automatic change-over to acceleration time 2 and deceleration time 2. • The change-over is effected if the frequency setpoint (absolute value) ≥ auto change-over threshold. • With the setting 0, the automatic change-over function is deactivated.
0x291D:003	Ramp times: Acceleration time 2 0.00 ... [**5.00**] ... 655.35 s	Acceleration time 2 for the operating mode "MS: Velocity mode". • The acceleration time set refers to the acceleration from standstill to the maximum frequency set. In the case of a lower setpoint selection, the actual acceleration time is reduced accordingly. • The acceleration time 2 is active if the frequency setpoint (absolute value) ≥ auto switching threshold 0x291B or the trigger assigned to the function "Activate ramp 2" in 0x2631:039 = TRUE. • Setting is not effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]".
0x291D:004	Ramp times: Deceleration time 2 0.00 ... [**5.00**] ... 655.35 s	Deceleration time 2 for the operating mode "MS: Velocity mode". • The set deceleration time refers to the period of deceleration from the set maximum frequency to standstill. In the case of a lower actual frequency, the actual deceleration time is reduced accordingly. • The deceleration time 2 is active if the frequency setpoint (absolute value) ≥ auto changeover threshold 0x291B or the trigger assigned to the function "Activate ramp 2" in 0x2631:039 = TRUE. • Setting is not effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]".
0x2631:039	Function list: Activate ramp 2 • Further possible settings: ▶ Trigger list 📖 58	Assignment of a trigger for the "Activate ramp 2" function. Trigger = TRUE: activate acceleration time 2 and deceleration time 2 manually. Trigger = FALSE: no action / deactivate function again. Notes: • If the function is used and the assigned trigger = TRUE, the auto changeover threshold 0x291B for ramp 2 is deactivated. • Acceleration time 2 can be set in 0x291D:003. • Deceleration time 2 can be set in 0x291D:004.
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).

Example for operating mode

- Switch S1 starts the motor in forward direction of rotation. Switch S1 in initial position stops the motor again.
- Switch S2 activates the acceleration time 2 and deceleration time 2.

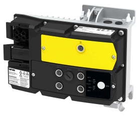
Connection diagram	Function	
	Switch S1	Run
	Switch S2	Activate ramp 2

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:039	Activate ramp 2	Digital input 2 [12]
0x2838:003	Stop method	Standard ramp [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz
0x291D:001	Acceleration time 1	10.00 s
0x291D:002	Deceleration time 1	10.00 s
0x291D:003	Acceleration time 2	5.00 s
0x291D:004	Deceleration time 2	5.00 s



The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

① Change-over to deceleration time 2 during the deceleration phase.
② Changeover to acceleration time 1 during the acceleration phase.



7.6 Setpoint diagnostics

The following parameters show the current setpoints of different setpoint sources.

Parameter

Address	Name / setting range / [default setting]	Information
0x282B:007	Inverter diagnostics: Default frequency setpoint • Read only: x.x Hz	Display of the frequency setpoint of the standard setpoint source set in 0x2860:001.
0x282B:008	Inverter diagnostics: Preset frequency setpoint • Read only: x.x Hz	Display of the preset frequency setpoint selected via the four functions "Activate preset (bit 0)" ... " Activate preset (bit 3)". ▸ Setpoint presets 📖 77
0x282B:009	Inverter diagnostics: Actual frequency setpoint • Read only: x.x Hz	Display of the currently selected frequency setpoint that is internally transferred to the motor control.
0x282B:010	Inverter diagnostics: Default PID setpoint • Read only: x.xx PID unit	Display of the PID control value of the standard setpoint source set in 0x2860:002.
0x282B:011	Inverter diagnostics: Preset PID setpoint • Read only: x.xx PID unit	Display of the preset PID setpoint selected via the four functions "Activate preset (bit 0)" ... " Activate preset (bit 3)". ▸ Setpoint presets 📖 77

8 Configuring the torque control

In general, the inverter is operated in a mode that controls the motor frequency. Alternatively, the inverter can be configured in such a way that it controls a motor torque within a defined frequency range.

Typical applications for such a torque control with frequency limitation are winders and packaging machines.

Preconditions

A torque control is only possible in the motor control type 0x2C00 = "Sensorless vector control (SLVC) [4]" or "Servo control (SC ASM) [2]". Thus, first this motor control type must be configured. For details see the following chapter:

- Sensorless vector control (SLVC) 116
- Servo control for asynchronous motor (SC-ASM) 115

After configuration of the motor control type, one of the following optimisations must be carried out for a torque control that is as precise as possible:

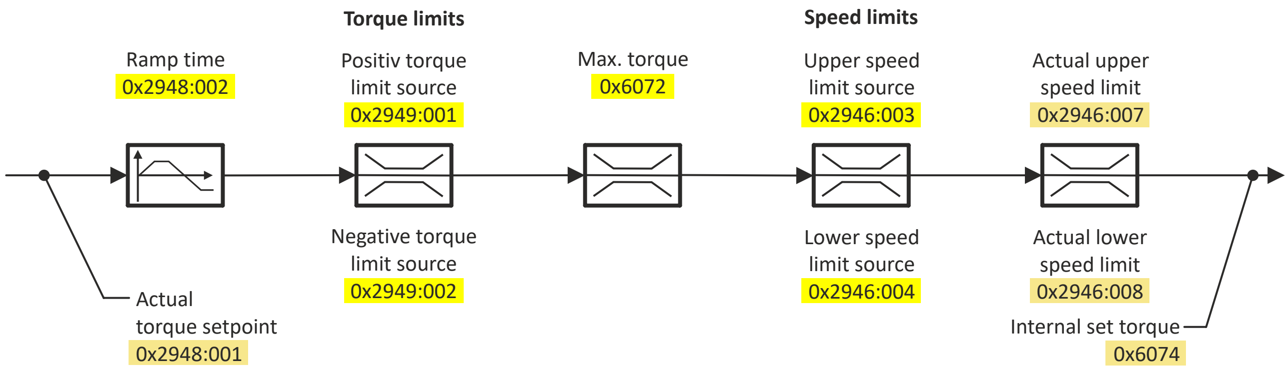
- Automatic motor identification (energized) 163
- Automatic motor calibration (non-energized) 164

8.1 Basic setting

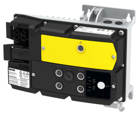
In the following, the steps required for configuring the torque control are described.

1. Select the motor control mode "Sensorless vector control (SLVC) [4]" or "Servo control (SC ASM) [2]" in 0x2C00.
2. Carry out motor adjustment. ▶ Configuring the motor control 📖 113
3. Select the operating mode "MS: Torque mode [-1]" in0x6060.
4. Select the standard setpoint source for the torque control in 0x2860:003.
5. Set the rated motor torque in 0x6076.
6. Set the torque limits. ▶ Torque limits 📖 100
7. Set the speed limitation. ▶ Speed limitation 📖 102
8. Configure setpoint sources 📖 104
9. Optional: Set the torque setpoint ramp time in 0x2948:002.

The following signal flow shows the internal setpoint logics:



The torque control with frequency limitation is now active and the inverter responds to the torque setpoint given by the selected setpoint source.



8.1.1 Standard setpoint source

The selected "setpoint source" serves to provide the inverter with its setpoint. The setpoint source can be selected individually for each operating mode.

Possible setpoint sources:

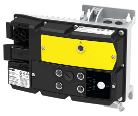
- Parameterizable setpoints (presets)
- Network
- IO-Link ports
- "Motor potentiometer" function
- "Analog signal scaling" function

Details

- For applications only requiring one setpoint, it is sufficient to define the standard setpoint source in 0x2860:003.
- For applications requiring a change-over of the setpoint source during operation, the functions for setpoint change-over have to be configured accordingly.
  ▸ Changing the setpoint source during operation 📖 92
  ▸ Configure setpoint sources 📖 104

Parameter

Address	Name / setting range / [default setting]		Information
0x2860:003	Torque control: Default setpoint source		Selection of the standard setpoint source for operating mode "MS: Torque mode". • The selected standard setpoint source is always active in the operating mode 0x6060 = "MS: Torque mode [-1]" when no setpoint change-over to another setpoint source via corresponding triggers/ functions is active.
	5	Network	The setpoint is defined as process data object via the network. ▸ Define setpoint via network 📖 271
	11	**Torque preset 1**	For the setpoint selection, preset values can be parameterised and selected. ▸ Setpoint presets 📖 104
	12	Torque preset 2	
	13	Torque preset 3	
	14	Torque preset 4	
	15	Torque preset 5	
	16	Torque preset 6	
	17	Torque preset 7	
	18	Torque preset 8	
	50	Motor potentiometer	The setpoint is generated by the "motor potentiometer" function. This function can be used as an alternative setpoint control which is controlled via two signals: "MOP setpoint up" and "MOP setpoint down". ▸ Motor potentiometer (MOP) 📖 105
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 📖 406
	231	Scaling2 value	

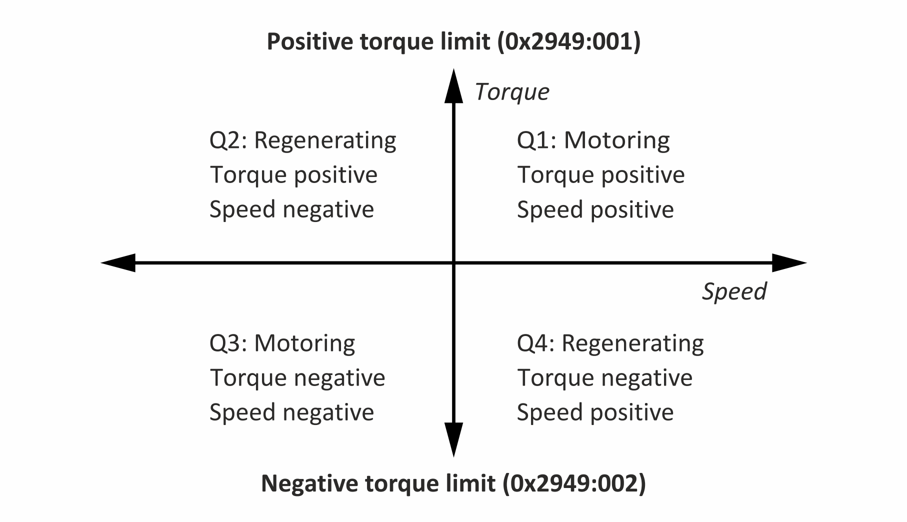


8.1.2 Torque limits

The necessary parameterizations can be found in the table.

Details

The positive and negative torque limit can be set independently of each other. The torque limit must be set to the maximum torque. ▸ 0x6072



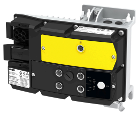
- Display of the current positive torque limit in 0x2949:004.
- Display of the current negative torque limit in 0x2949:003.

The torque limits are also active in the "Velocity Mode" with the "Servo control (SC-ASM)" motor control mode.

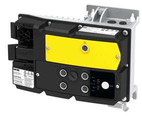
Regardless of the setting in 0x2949:001 and 0x2949:002, the maximum torque does not exceed the value configured in 0x6072.

Parameter

Address	Name / setting range / [default setting]		Information
0x2949:001	Torque limit source selection: Positive torque limit source		Selection of the source for the positive torque limit source.
	0	**Max torque**	Positive torque limit source = Max. torque 0x6072.
	1	Fixed Limit 0.0 %	Positive torque limit source = 0.0 %.
	4	Positive torque limit	Positive torque limit source = Positive torque limit 0x60E0.
	5	Network target torque	The positive torque limit source is defined as process data object via network. ▸ Mappable parameters for exchanging setpoints and actual values 📖 273
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	



Address	Name / setting range / [default setting]		Information
0x2949:002	Torque limit source selection: Negative torque limit source		Selection of the source for the negative torque limit source.
	0	**(-) Max torque**	Negative torque limit source = (-) Max. torque 0x6072.
	1	Fixed Limit 0.0 %	Negative torque limit source = 0.0 %.
	4	Negative torque limit	Negative torque limit source = Negative torque limit 0x60E1.
	5	Network target torque	The negative torque limit source is defined as process data object via network. ▸ Mappable parameters for exchanging setpoints and actual values 📖 273
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
0x60E0	Positive torque limit 0.0 ... [**250.0**] ... 3276.7 %		Positive torque limit source for speed control with torque limitation. • 100 % = Rated motor torque 0x6076
0x60E1	Negative torque limit 0.0 ... [**250.0**] ... 3276.7 %		Negative torque limit source for speed control with torque limitation. • 100 % = Rated motor torque 0x6076



8.1.3 Speed limitation

The torque control controls the assigned torque setpoint within the set speed limits. The actual speed results from the load conditions of the application. For example, high speeds may occur in a torque control if no counter torque is available (load-free machine).

When the actual speed reaches the set speed limits, it is kept on the respective limit value. This function is also called "speed limitation".

Details

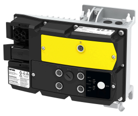
The lower and upper speed limit for speed limitation can be set independently of each other. The specification can also be made via network or IO-Link ports.

Required parameter setting:

1. Select the source for the upper speed limit in 0x2946:003.
   - Default setting: Maximum frequency 0x2916
   - In case of selection "Upper frequency limit [4]": Set the upper speed limit in [Hz] in 0x2946:005.
   - In case of selection "Upper speed limit [5]": Set the upper speed limit in [vel. unit] in 0x2946:001.
   - The current upper speed limit is displayed in 0x2946:007.
2. Select the source for the lower speed limit in 0x2946:004.
   - Default setting: (-) Maximum frequency 0x2916
   - In case of selection "Lower frequency limit [4]": Set the lower speed limit in [Hz] in 0x2946:006.
   - In case of selection "Lower speed limit [5]": Set the lower speed limit in [vel. unit] in 0x2946:002.
   - The output frequency is absolutely limited regardless of the setting 0x2946:003 and 0x2946:004 by 0x2916 in the “Torque mode”.
   - The current lower speed limit is displayed in 0x2946:008.

Parameter

Address	Name / setting range / [default setting]	Information
0x2946:001	Speed limitation: Upper speed limit -480000 ... [**0**] ... 480000 rpm	Upper limit for the speed limitation. • Setting is only effective with the selection "Upper speed limit [5]" in 0x2946:003. • Entry via Lenze Tools is in rpm! • Via RPDO, the unit is vel. unit. and the scaling must be taken into account. • ± 480000 rpm = ±2 ^ 31 [n-unit]
0x2946:002	Speed limitation: Lower speed limit -480000 ... [**0**] ... 480000 rpm	Lower limit for speed limitation. • Setting is only effective with the selection "Lower speed limit [5]" in 0x2946:004. • Entry via Lenze Tools is in rpm! • Via RPDO, the unit is vel. unit. and the scaling must be taken into account. • ± 480000 rpm = ±2 ^ 31 [n-unit]

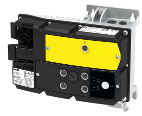


Address	Name / setting range / [default setting]		Information
0x2946:003	Speed limitation: Upper speed limit source		Selection of the source for the upper speed limit.
	0	**Maximum frequency**	Upper speed limit = Maximum frequency 0x2916.
	1	Fixed Limit 0.0 Hz	Upper speed limit = 0.0 Hz.
	4	Upper frequency limit	Upper speed limit = setting in 0x2946:005 in [Hz].
	5	Upper speed limit	Upper speed limit = setting in 0x2946:001 in [vel. unit].
	6	Network target velocity	The upper speed limit is defined as process data object via network. ▶ Mappable parameters for exchanging setpoints and actual values 📖 273
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▶ Configure function assignment 📖 188 ▶ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
0x2946:004	Speed limitation: Lower speed limit source		Selection of the source for the lower speed limit.
	0	**(-) Maximum frequency**	Lower speed limit = (-) Maximum frequency 0x2916.
	1	Fixed Limit 0.0 Hz	Lower speed limit = 0.0 Hz.
	4	Lower frequency limit	Lower speed limit = setting in 0x2946:006 in [Hz].
	5	Lower speed limit	Lower speed limit = setting in 0x2946:002 in [vel. unit].
	6	Network target velocity	The lower speed limit is defined as process data object via network. ▶ Mappable parameters for exchanging setpoints and actual values 📖 273
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▶ Configure function assignment 📖 188 ▶ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
0x2946:005	Speed limitation: Upper frequency limit -1000.0 ... [**50.0**] ... 1000.0 Hz		Upper limit for the speed limitation. • Setting is only effective with the selection "Upper frequency limit [4]" in 0x2946:003.
0x2946:006	Speed limitation: Lower frequency limit -1000.0 ... [**-50.0**] ... 1000.0 Hz		Lower limit for speed limitation. • Setting is only effective with the selection "Lower frequency limit [4]" in 0x2946:004.
0x2946:007	Speed limitation: Actual upper speed limit • Read only: x.x Hz		Display of the current upper limit for speed limitation.
0x2946:008	Speed limitation: Actual lower speed limit • Read only: x.x Hz		Display of the current lower limit for speed limitation.

8.1.4 Ramp time

Parameter

Address	Name / setting range / [default setting]	Information
0x2948:002	Torque setpoint: ramp time 0.0 ... [**1.0**] ... 60.0 s	Ramp time for operating mode "MS: Torque mode". • The torque setpoint is led via a ramp generator. This provides for a "smooth" switch-over between different setpoint sources. • The ramp time refers to max. torque 0x6072. At a lower setpoint selection, the actual ramp time is reduced accordingly.



8.2 Configure setpoint sources

The standard setpoint source for torque control can be selected in 0x2860:003. This chapter describes the setting options for the various setpoint sources.

- Preset torque setpoint source: Torque preset 1 (0x2912:001)
- Except for the network, the torque setpoint must be given in percent with regard to the 0x6076 rated motor torque.
- Via network the torque setpoint is selected via the mappable parameter 0x400B:008 in [Nm / $2^{\text{scaling factor}}$]. The scaling factor can be set in 0x400B:009.
- Corresponding functions make it possible to change over to other setpoint sources during operation. More detailed information on this can be found in the chapter "Configuring frequency control" ▶ Changing the setpoint source during operation 📖 92

The following setpoint sources are described in this chapter:

- Setpoint presets 📖 104
- Motor potentiometer (MOP) 📖 105

Other setpoint source descriptions can be found here:

- Network: Define setpoint via network 📖 271
- IO-Link ports: Configure IO-Link ports 📖 205
- Function "Analog signal scaling" 📖 406

8.2.1 Setpoint presets

8 different torque setpoints (presets) can be parameterised for the torque control.

Parameter

Address	Name / setting range / [default setting]	Information
0x2912:001	Torque setpoint presets: Preset 1 -400.0 ... [**100.0**] ... 400.0 %	Parameterisable torque setpoints (presets) for operating mode "MS: Torque mode". • 100 % = Rated motor torque 0x6076
0x2912:002	Torque setpoint presets: Preset 2 -400.0 ... [**100.0**] ... 400.0 %	
0x2912:003	Torque setpoint presets: Preset 3 -400.0 ... [**100.0**] ... 400.0 %	
0x2912:004	Torque setpoint presets: Preset 4 -400.0 ... [**100.0**] ... 400.0 %	
0x2912:005	Torque setpoint presets: Preset 5 -400.0 ... [**100.0**] ... 400.0 %	
0x2912:006	Torque setpoint presets: Preset 6 -400.0 ... [**100.0**] ... 400.0 %	
0x2912:007	Torque setpoint presets: Preset 7 -400.0 ... [**100.0**] ... 400.0 %	
0x2912:008	Torque setpoint presets: Preset 8 -400.0 ... [**100.0**] ... 400.0 %	

A switch-over to a preset during operation is also possible as an alternative to the standard setpoint source setting.

8.2.2 Motor potentiometer (MOP)

The "Motor potentiometer" function can be used as an alternative setpoint control that is controlled via two functions: "MOP setpoint up" and "MOP setpoint down".

Details

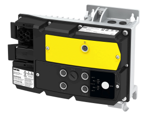
The "Motor potentiometer (MOP)“ function is described in detail in the chapter "Configuring frequency control". 78

The following parameters of the function are only relevant for torque control.

Parameter

Address	Name / setting range / [default setting]	Information
0x4004:003	MOP starting values: Torque 0.0 ... [**0.0**] ... 1000.0 %	Starting value for operating mode "MS: Torque mode". • This value is used as initial value if "Starting value [1]" is set in 0x4003. • 100 % = motor rated torque (0x6076).
0x4009:003	MOP values saved: Torque • Read only: x.x %	Display of the last MOP value saved internally for the operating mode "MS: Torque mode". • This value is used as initial value if "Last value [0]" is set in 0x4003. • 100 % = motor rated torque (0x6076).

A switch-over to the motor potentiometer during operation is also possible as an alternative to the standard setpoint source setting.

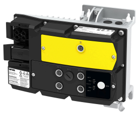


8.3 Process input data (CiA 402 objects)

These objects can be used for the CiA 402 "MS: Torque mode" operating mode. The CiA 402 operating mode "Profile Torque mode" is not supported.

Parameter

Address	Name / setting range / [default setting]		Information
0x6060	CiA: Operation mode • Setting can only be changed if the inverter is disabled.		CiA: Operation mode
	-2	**MS: Velocity mode**	Vendor specific velocity mode ▸ Configuring the frequency control 📖 73
	-1	MS: Torque mode	Vendor specific torque mode • Only possible in motor control type 0x2C00 = "Sensorless vector control (SLVC) [4]" or "Servo control (SC ASM) [2]". ▸ Configuring the torque control 📖 97
	0	No selection	No selection
	2	CiA: Velocity mode (vl)	CiA: Velocity mode ▸ CiA 402 device profile 📖 280
0x6071	Set torque -3276.8 ... [**0.0**] ... 3276.7 %		Setting of the setpoint torque for the torque operating modes. • 100 % = Rated motor torque 0x6076 The inverter does not support the CiA 402 torque mode.

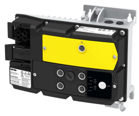


8.4 Process output data (CiA 402 objects)

These objects can be used for the CiA 402 mode "MS: Torque mode". The CiA 402 mode "Profile Torque mode" is not supported.

Parameter

Address	Name / setting range / [default setting]	Information
0x6074	Internal set torque • Read only: x.x %	Display of the internal set torque. • 100 % = Rated motor torque 0x6076
0x6077	Actual torque • Read only: x.x %	Display of the actual torque. • 100 % = Rated motor torque 0x6076

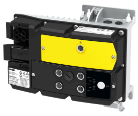


8.5 Setpoint diagnostics

The following parameters provide information on the setpoints set for torque control.

Parameter

Address	Name / setting range / [default setting]	Information
0x282B:012	Inverter diagnostics: Default torque setpoint • Read only: x.x %	Display of the torque setpoint of the standard setpoint source set in 0x2860:003. • 100 % = Rated motor torque 0x6076
0x282B:013	Inverter diagnostics: Preset torque setpoint • Read only: x.x %	Display of the preset torque setpoint selected via the four functions "Activate preset (bit 0)" ... " Activate preset (bit 3)". ▸ Setpoint presets 📖 104
0x2948:001	Torque setpoint: Actual torque setpoint • Read only: x.x %	Display of the currently selected torque setpoint that is internally transferred to the motor control. • 100 % = Rated motor torque 0x6076
0x2949:003	Torque limit source selection: Actual positive torque limit • Read only: x.x %	Display of the current positive torque limit. • 100 % = Rated motor torque 0x6076
0x2949:004	Torque limit source selection: Actual negative torque limit • Read only: x.x %	Display of the current negative torque limit. • 100 % = Rated motor torque 0x6076
0x2DD5	Torque setpoint • Read only: x.xx Nm	Display of the current torque setpoint.



9 Configuring the feedback system

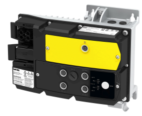
The inverter supports HTL encoders only.

An HTL encoder connected to connector X3.2 can be used for the following tasks:

- As motor encoder for a motor speed feedback for speed control that is as precise as possible (SC-ASM). ▸ Servo control for asynchronous motor (SC-ASM) 115
- As setpoint encoder. ▸ Configure HTL input 199

This chapter describes how to use the HTL encoder as a motor encoder.

The HTL encoder connected to the inverter is **not** automatically set as the feedback system for motor control if a motor is selected from the motor catalog!



9.1 Configure encoder input

Connector X3.2 can be configured as an encoder input to evaluate the signal of a low-cost HTL encoder.

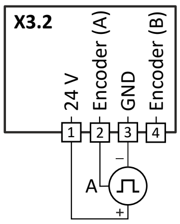
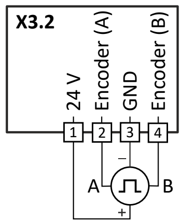
Preconditions

- Single-track or two-track HTL encoder.
  - A single-track HTL encoder (track A) cannot be used for motor speed feedback.
  - A two-track HTL encoder (track A and B) must have a phase offset of exactly 90° between track A and B (error ≤ ± 10°). Inverted tracks are not required.
- Encoder increments: ≤ 16384 increments per revolution
- For supplying the encoder, the maximum supply current of the inverter must be considered. If necessary, an external 24 V voltage supply for the encoder is required.
- The function assignment of connector X3.2 must be configured to "Encoder [0]" in 0x2630:011.

Restrictions

- With setting 0x2630:011 = "Encoder [0]", the digital inputs DI3 and DI4 or the HTL input for the detection of a reference frequency ("pulse train") are no longer available.
- The maximum input frequency is 200 kHz. If this frequency is exceeded, an error is triggered.

Connection

Connection of a single-track HTL encoder (without external 24-V voltage supply)	**Connection of a two-track HTL encoder (without external 24-V voltage supply)**
	

Details

Encoder dimensioning: Calculate maximum number of increments per revolution of the encoder	
Max. encoder increments = f_{max} [Hz] * 60 s / n_{max} [rpm] Max. encoder increments = 200000 [Hz] * 60 s / 1500 [rpm] = 8000 increments/revolution	
f_{max}	Maximum input frequency of the encoder inputs = 200 kHz = 200000 Hz
n_{max}	Maximum encoder speed (in this example: 1500 rpm)
Max. encoder increments	Maximum number of increments per encoder revolution

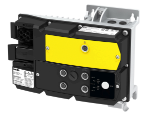
Select an encoder with a maximum number of increments per revolution which is lower than or equal to the calculated number. The higher the number of increments per revolution, the more stable the system is.

Basic steps for configuring the encoder in the »EASY Starter«:

1. Set the selection "Encoder [1]" in0x2630:011 to configure connector X3.2 as encoder input.
2. Set the encoder number of increments per revolution in 0x2C42:001 according to the manufacturer data/encoder data sheet.

Parameter

Address	Name / setting range / [default setting]	Information
0x2C42:001	Encoder settings: Increments/revolution 1 ... [**128**] ... 16384 • Setting can only be changed if the inverter is disabled.	Setting of the encoder number of increments per revolution (according to manufacturer data/encoder data sheet).
0x2C42:006	Encoder settings: Actual velocity • Read only: x rpm	Display of the speed currently detected by the encoder.
0x2C42:007	Encoder settings: Status • Read only	Bit coded display of the status of encoder monitoring. Display of the encoder status.
	Bit 0 Maximum encoder speed reached	1 = the calculated encoder maximum frequency is beyond the permissible frequency range of the digital inputs.
	Bit 4 No signal detected	1 = a complete failure of the encoder signals has been detected. No pulse detected.
	Bit 5 Encoder track A or B missing	1 = a failure of only one track (track A or track B) has been detected. Weak pulses (one of the tracks A or B is missing).
0x2C45	Motor feedback error response	Selection of the response to the triggering of the encoder signal loss monitoring. The monitoring is only active if the HTL encoder • is set as feedback system for the motor control or • used as signal source for the "Position counter" function. 423 Associated error code: • 29445 | 0x7305 - Encoder open circuit
	0 No response	▶ Error types 444
	12 Warning	
	23 Fault	



9.2 Synchronous motor: Pole position identification (PPI)

For the control of a permanent-magnet synchronous motor, the pole position – the angle between motor phase U and the field axis of the rotor – must be known. The determination of this angle can be done by a so called "Pole Position Identification (PLI)".

Preconditions

In 0x2C00 the motor control type "Sensorless control (SL PSM) [3]" is selected.

9.2.1 Pole position identification (PPI) without movement

The "Pole position identification (PLI) without movement" function can also be used if no motor revolution is possible (holding brake active).

NOTICE

With an incorrect parameter setting and dimensioning of the inverter, the maximum permissible motor current may be exceeded during the pole position identification.

Possible consequences: Irreversible damage of the motor

- Set the motor data correctly. ▶ Motor data 📖 46
- Only use an inverter that is performance-matched to the motor.

Conditions

- The wiring of the three motor phases and the motor encoder must be carried out according to the specifications from the mounting instructions.
- The inverter is ready for operation (no fault active).
- For the pole position identification (PPI) without movement, the motor must be at standstill.

Parameter

Address	Name / setting range / [default setting]		Information
0x2C63:001	PPI without movement: Execution • Setting can only be changed if the inverter is disabled.		Start behavior (with or without pole position identification before the start).
	0	Disabled	No pole position is identified.
	2	**After each enable**	After every inverter release, the pole position is identified without any movement.
0x2C63:002	PPI without movement: Current adjust factor 50 ... [**100**] ... 500 % • Setting can only be changed if the inverter is disabled.		

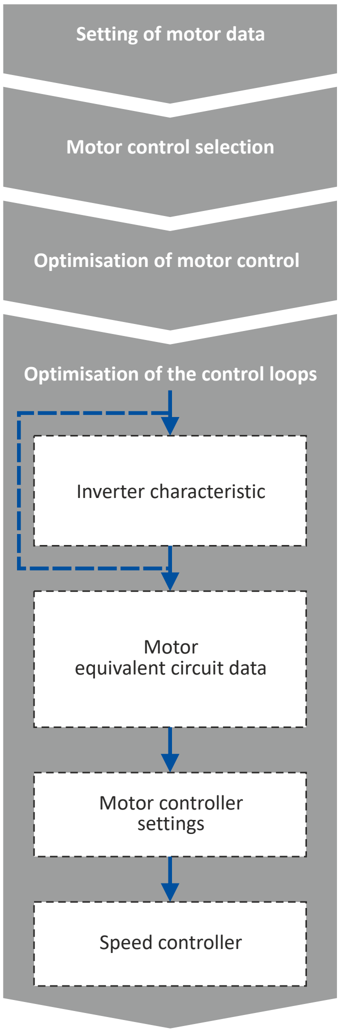
10 Configuring the motor control

This chapter contains all functions and settings relevant for the motor control.

Basic procedure of commissioning the motor control

In the first step, the rated data of the motor must be set. The other steps depend on the respective application case.

There are several options for setting the motor data and optimising the control loops. Basically, you can select between a manual and an automatic process. Whether a setting can be applied or not depends on the motor (Lenze motor yes/no) and the application. If possible, always use the possible setting listed first in the following diagram since this one leads to the most accurate results.



Possible settings:
a) Using data from motor catalogue
b) Entering data manually (e.g. from the nameplate)

Options:
V/f characteristic control (open-loop) (default setting), V/f characteristic control (closed-loop), servo control, sensorless control, sensorless vector control

Parameterisable functions:
V/f voltage boost, skip frequencies, optimisation of the stalling behaviour, slip compensation, oscillation damping

Possible settings:
a) Identifying data automatically (by inverter)
b) Calibrating data automatically (by inverter or engineering tool)
c) Loading preset inverter characteristics

Possible settings:
a) Identifying data automatically (by inverter)
b) Using data from the motor catalogue
c) Calibrating data automatically (by inverter or engineering tool)
d) Entering data manually

Possible settings:
a) Identifying data automatically (by inverter)
b) Entering data manually

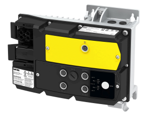
Possible settings:
a) Identifying data automatically (by inverter)
b) Entering data manually

Related topics

Basic setting ▸ Motor data 46

Basic setting ▸ Motor control mode 50

Configuring the motor control



Guide for this chapter

In the following subchapters, each motor control type is described in detail:

This chapter also contains information on the following subjects:

10.1 Servo control for asynchronous motor (SC-ASM)

The field-oriented servo control is based on a separated control of the torque-producing and field-producing current components. The motor control is based on a feedback, field-oriented and cascaded controller structure and enables a dynamic and stable operation in all four quadrants.

Preconditions

- The servo control (SC ASM) is only suitable for asynchronous motors.
- The servo control (SC-ASM) requires a feedback of the speed. A HTL encoder must be connected to the inverter and set as feedback system for the motor control.

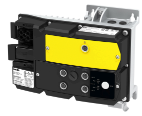
Details

Fundamentally, the servo control has the same advantages as the sensorless vector control (SLVC). Compared to the V/f characteristic control without feedback, the following can be achieved by means of the servo control:

- A higher maximum torque throughout the entire speed range
- A higher speed accuracy
- A higher concentricity factor
- A higher level of efficiency
- The implementation of torque-actuated operation with speed limitation
- The limitation of the maximum torque in motor and generator mode for speed-actuated operation

10.1.1 Required commissioning steps

1. Configuring the feedback system 📖 109
2. Activate motor control type: 0x2C00 = "Servo control (SC ASM) [2]".
3. Carry out optimisation of the control circuits.
   - **An optimum operation of this motor control type requires an optimisation of the control loops!**
   - Details: ▶ Options for optimizing the control loops 📖 161
4. Optionally for a speed control with torque limitation in operating mode 0x6060 = "MS: Velocity mode [-2]":
   - Select the source in 0x2949:001 for the positive torque limit source and set it accordingly.
   - Select the source in 0x2949:002 for the negative torque limit source and set it accordingly.



10.2 Sensorless vector control (SLVC)

The sensorless (field-oriented) vector control for asynchronous motors is based on a decoupled control for the torque-producing and the field-producing current component. In addition, the actual speed is reconstructed by means of a motor model so that a speed sensor is not required.

Preconditions

- The sensorless vector control (SLVC) is only suitable for asynchronous motors.
- The multi-motor operation is not permitted for sensorless vector control (SLVC).

⚠CAUTION!

Do not operate with hoisting units!

Operation of the sensorless vector control (SLVC) is **not** permissible for hoisting units!

▶ Do not operate the vector control with hoisting units.

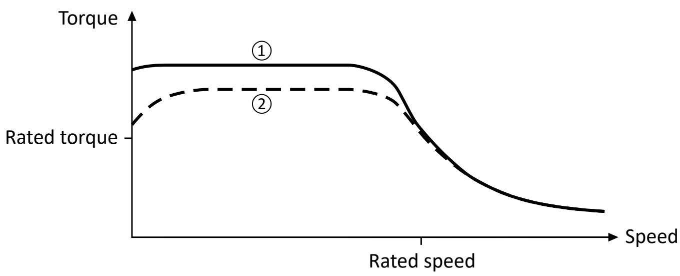
Supported operating modes 0x6060:

- "MS: Velocity mode [-2]"
- "CiA: Velocity mode (vl) [2]"

Details

Compared to the V/f characteristics, the sensorless vector control (SLVC) serves to achieve improved drive characteristics thanks to:

- higher torque throughout the entire speed range
- higher speed accuracy and smooth running properties
- higher efficiency

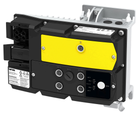


① Sensorless vector control (SLVC)

② V/f characteristic control for asynchronous motor (VFC open loop) 118

10.2.1 Required commissioning steps

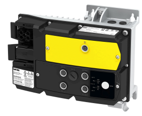
1. Activate motor control type: 0x2C00 = "Sensorless vector control (SLVC) [4]".
2. Carry out optimisation of the control circuits.
   - **An optimum operation of this motor control type requires an optimisation of the control loops!**
   - Details: ▶ Options for optimizing the control loops 161
3. Optionally for a speed control with torque limitation in operating mode 0x6060 = "MS: Velocity mode [-2]":
   - Select the source in 0x2949:001 for the positive torque limit source and set it accordingly.
   - Select the source in 0x2949:002 for the negative torque limit source and set it accordingly.



10.2.2 Expert settings

Parameter

Address	Name / setting range / [default setting]	Information
0x2B40:003	SLVC: Q-Feedforward 0.00 ... [**0.00**] ... 10000.00	Feedforward control for the SLVC Q controller.
0x2B40:004	SLVC: D-Feedforward 0.00 ... [**0.00**] ... 10000.00	Feedforward control of the SLVC-D controller.



10.3 V/f characteristic control for asynchronous motor (VFC open loop)

The V/f characteristic control is a motor control for conventional frequency inverter applications. It is based on a simple and robust control mode for the operation of asynchronous motors with a linear or square-law load torque characteristic (e.g. fan). Because of the minimal parameterisation effort, such applications can be commissioned easily and quickly.

Preconditions

- The V/f characteristic control is only suitable for asynchronous motors.
- If you want to actuate a drive with a square-law V/f characteristic: Please always check whether the corresponding application is suitable for operation with a square-law V/f characteristic!
- Set the motor data according to the information on the nameplate of the motor. ▶ Motor data 📖 46

10.3.1 Required commissioning steps

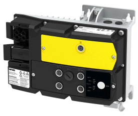
1. Activate motor control type: 0x2C00 = "V/f characteristic control (VFC open loop) [6]".
2. Set limiting factors for the V/f characteristic:
   1. Rated mains voltage 0x2540:001
   2. Minimum frequency 0x2915
   3. Maximum frequency 0x2916
3. Set V/f characteristic data:
   1. Base voltage 0x2B01:001
   2. Base frequency 0x2B01:002
4. Select a characteristic shape suitable for the application in 0x2B00.
5. Optional settings:
   - Set voltage boost 📖 126
   - Set slip compensation 📖 127
   - Set oscillation damping 📖 129
   - Optimising the stalling behaviour 📖 130
   - Flying restart circuit 📖 133
   - Additive voltage impression 📖 135
6. Optional: carry out optimisation of the control circuits.
   - An optimisation of the control circuits is not mandatory for this motor control type but may lead to better control operation. The control parameters should always be calculated if the motor power does not correspond to the inverter power in order to achieve optimum performance from the slip compensation. (It is sufficient to carry out the "NonEnergized" calculation.)
   - Details: ▶ Options for optimizing the control loops 📖 161

10.3.2 Basic setting

The base voltage and the base frequency define the ratio of the two variables and thus the gradient of the V/f characteristic.

Parameter

Address	Name / setting range / [default setting]	Information
0x2B01:001	V/f shape data: Base voltage 0 ... [**400**] ... 5000 V	Base voltage and base frequency define the V/f ratio and thus the gradient of the V/f characteristic. • The V/f base voltage is usually set to the rated motor voltage 0x2C01:007. • The V/f base frequency is usually set to the rated motor frequency 0x2C01:005.
0x2B01:002	V/f shape data: Base frequency 0 ... [**50**] ... 1500 Hz	

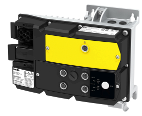


10.3.3 Define V/f characteristic shape

Various characteristic shapes are available which are described in detail in the following subchapters.

Parameter

Address	Name / setting range / [default setting]		Information
0x2B00	V/f characteristic shape • Setting can only be changed if the inverter is disabled.		Selection of the V/f characteristic shape for the adaptation to different load profiles.
	0	**Linear**	Linear characteristic for drives with constant load torque over the speed. ▸ Linear V/f characteristic 📖 120
	1	Quadratic	Square-law characteristic for drives with a square-law load torque over the speed. • Square-law V/f characteristics are preferably used for centrifugal pumps and fan drives. • Please always check whether the corresponding application is suitable for operation with a square-law V/f characteristic! • If your pump drive or fan drive is not suitable for operation with a square-law V/f characteristic, use the linear V/f characteristic instead. ▸ Square-law V/f characteristic 📖 121
	2	Multipoint	Linear characteristic with additional characteristic point for adaptation to applications with special torque characteristics. ▸ Multipoint V/f characteristic 📖 122
	3	Eco	Linear characteristic with energy optimisation in the partial load operational range. ▸ Energy-saving V/f characteristic (VFC-Eco) 📖 123
	4	Adaptive	Freely definable characteristic curve with 11 parameterizable grid points (voltage/frequency values). ▸ User-definable V/f characteristic 📖 124



10.3.3.1 Linear V/f characteristic

The linear V/f characteristic leads to a constant torque.

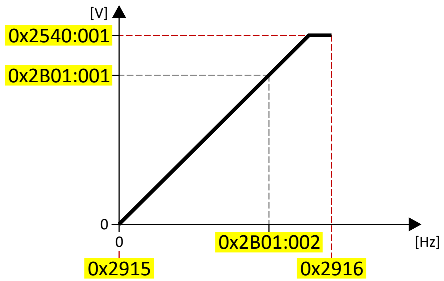
Details

Select V/f characteristic control with linear characteristic:

1. Motor control mode 0x2C00 = "V/f characteristic control (VFC open loop) [6]"
2. V/f characteristic shape 0x2B00 = "Linear [0]"

Setting of the V/f characteristic:

- Limiting factors for the V/f characteristic are the rated mains voltage 0x2540:001, the minimum frequency 0x2915 and the maximum frequency 0x2916.
- The base voltage 0x2B01:001 is usually set to the rated motor voltage (motor nameplate data). The base voltage is preset to the rated mains voltage. This in turn is preset according to the product key of the inverter. ▶ Mains voltage 📖 36
- The base frequency 0x2B01:002 is usually set to the rated motor frequency (motor nameplate data).



The actual output frequency can exceed the set maximum frequency if the gain for the slip compensation in 0x2B09:001 is set to a value higher than 0.

Example

Mot power

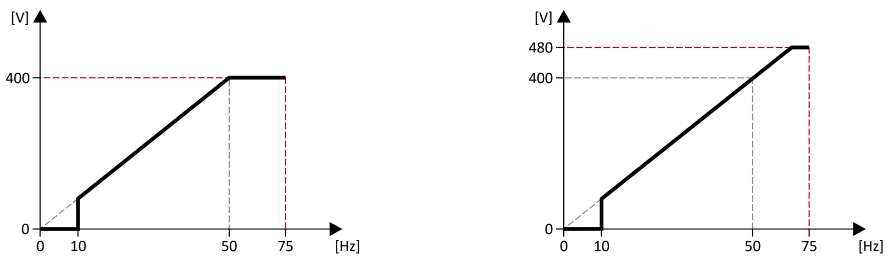
- 400 V/50 Hz

Settings

- Maximum frequency 75 Hz
- Minimum frequency 10 Hz

Explanation

- Graphic on the left: The inverter is operated with a rated mains voltage of 400 V.
- Graphic on the right: The inverter is operated with a rated mains voltage of 480 V. This allows the output voltage to further increase above 50 Hz.



Parameter	Designation	Setting for this example
0x2540:001	Rated mains voltage	400 Veff [1] (on the left) / 480 Veff [2] (on the right)
0x2915	Minimum frequency	10 Hz
0x2916	Maximum frequency	75 Hz
0x2B01:001	Base voltage	400 V
0x2B01:002	Base frequency	50 Hz

10.3.3.2 Square-law V/f characteristic

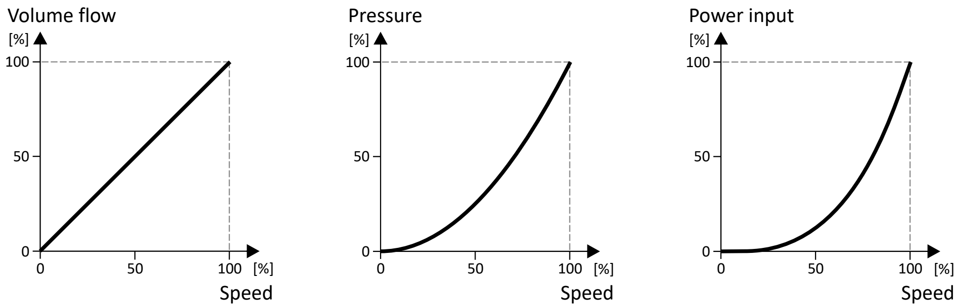
The square-law V/f characteristic is typically used in heating, ventilation and climate applications to control the speed of fans and centrifugal pumps.

Details

Each application that is provided with the features according to the affinity laws may possibly benefit from a square-law V/f characteristic.

The affinity laws describe the relation between the speed and other variables:

- The volume flow increases proportionately to the speed.
- The required pressure behaves proportionately to the square of the speed.
- The power input is proportionately to the cube of the speed. This means that already a minimal reduction of the speed may lead to substantial savings in energy consumption.



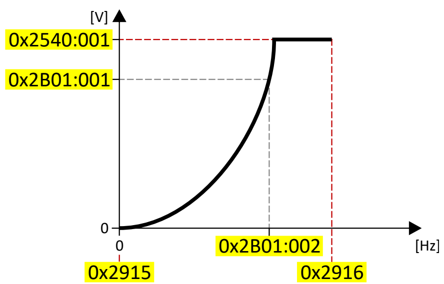
By approximation, the square-law V/f characteristic corresponds to the curve for power input shown above. At low frequencies, the voltage is reduced since due to the type of load a lower voltage is sufficient to generate the required power. All in all, this results in an energy-efficient system.

Select V/f characteristic control with square-law characteristic:

1. Motor control mode 0x2C00 = "V/f characteristic control (VFC open loop) [6]"
2. V/f characteristic shape 0x2B00 = "Quadratic [1]"

Setting of the V/f characteristic:

- Limiting factors for the V/f characteristic are the rated mains voltage 0x2540:001, the minimum frequency 0x2915 and the maximum frequency 0x2916.
- The base voltage 0x2B01:001 is usually set to the rated motor voltage (motor nameplate data). The base voltage is preset to the rated mains voltage. This in turn is preset according to the product key of the inverter. ▶ Mains voltage 📖 36
- The base frequency 0x2B01:002 is usually set to the rated motor frequency (motor nameplate data).



The actual output frequency can exceed the set maximum frequency if the gain for the slip compensation in 0x2B09:001 is set to a value higher than 0.

10.3.3.3 Multipoint V/f characteristic

The multipoint V/f characteristic is based on the linear V/f characteristic. An additional characteristic point enables the adaptation to applications with special torque properties.

Details

This characteristic shape is suitable for applications that require a higher torque at lower speeds. The additional characteristic point can be configured in such a way that a higher voltage is provided in the lower frequency range of the characteristic. Otherwise, the same limits apply for the Multipoint characteristic as for the linear characteristic.

Select V/f characteristic control with Multipoint characteristic:

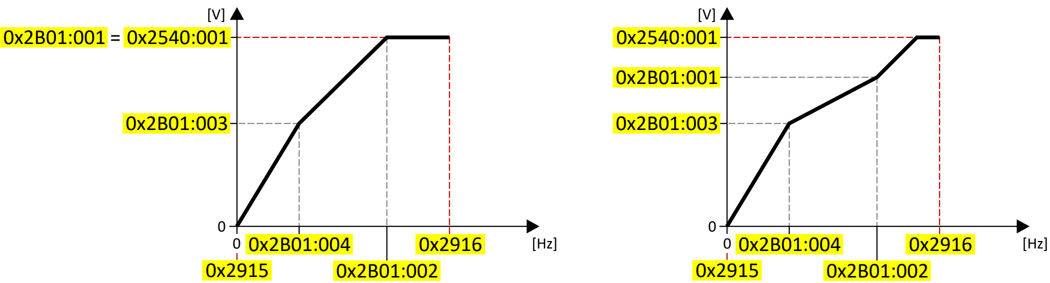
1. Motor control mode 0x2C00 = "V/f characteristic control (VFC open loop) [6]"
2. V/f characteristic shape 0x2B00 = "Multipoint [2]"

Setting of the V/f characteristic:

- Limiting factors for the V/f characteristic:
  - Rated mains voltage 0x2540:001
  - Minimum frequency 0x2915
  - Maximum frequency 0x2916
- The rated mains voltage is set as the base voltage 0x2B01:001. The rated mains voltage corresponds to the product key of the inverter . The base voltage is set to the rated motor voltage (motor nameplate specification).
- The base frequency 0x2B01:002 is set to the rated motor frequency (motor nameplate data).
- The additional characteristic point is defined based on the parameters 0x2B01:003 and 0x2B01:004.

Characteristic examples:

- Graphic on the left: the base voltage is set equal to rated mains voltage.
- Graphic on the right: the base voltage is set lower than the rated mains voltage.



Parameter

Address	Name / setting range / [default setting]	Information
0x2B01:003	V/f shape data: Midpoint voltage 0 ... **[0]** ... 5000 V	Definition of the medium characteristic point for user-definable V/f characteristic. • Only relevant if V/f characteristic shape 0x2B00 is set = "Adaptive [2]".
0x2B01:004	V/f shape data: Midpoint frequency 0 ... **[0]** ... 1500 Hz	

10.3.3.4 Energy-saving V/f characteristic (VFC-Eco)

In the case of the energy-saving V/f characteristic control (VFC-Eco), the motor voltage of the inverter is ascertained based on a linear characteristic as a function of the rotary field frequency or the motor speed to be generated. In addition, the motor is always operated in the optimum efficiency range by means of a cosϕ control and the resulting voltage dip (reduction of copper losses in the asynchronous motor). This is useful for energy efficiency with applications such as conveyors, where the torque and energy requirements are high during acceleration, but lower as soon as the load reaches the stationary speed.

Details

Select energy-saving V/f characteristic control with linear characteristic:

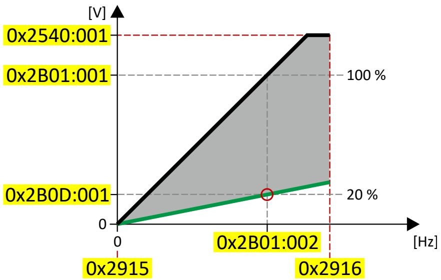
1. Motor control mode 0x2C00 = "V/f characteristic control (VFC open loop) [6]"
2. V/f characteristic shape 0x2B00 = "Eco [3]"

Setting of the V/f characteristic:

- The limiting factors for the V/f characteristic are the rated mains voltage 0x2540:001, the minimum frequency 0x2915 and the maximum frequency 0x2916.
- The base voltage 0x2B01:001 is usually set to the rated motor voltage (motor nameplate data). The base voltage is preset to the rated mains voltage. This in turn is preset according to the product key of the inverter. ▸ Mains voltage 🕮 36
- The base frequency 0x2B01:002 is usually set to the rated motor frequency (motor nameplate data).

Eco efficiency range:

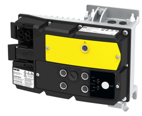
- The Eco efficiency range (grey) is between the V/f-standard characteristic (black) and the V/f Eco characteristic (green).
- The V/f Eco characteristic (green) is defined by the operating point that results from the minimum voltage 0x2B0D:001 and the base frequency 0x2B01:002.
- The minimum voltage 0x2B0D:001 has to be set in percent with reference to the base voltage 0x2B01:001.



The actual output frequency can exceed the set maximum frequency if the gain for the slip compensation in 0x2B09:001 is set to a value higher than 0.

Parameter

Address	Name / setting range / [default setting]	Information
0x2B0D:001	VFC-ECO: Minimum voltage 20 ... **[20]** ... 100 %	Defining the operating point of the V/f eco characteristic. The V/f eco characteristic defines the lower limit of the eco efficiency range. • 100 % = Base voltage 0x2B01:001
0x2B0D:006	VFC-ECO: Cos phi actual value • Read only	



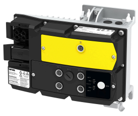
10.3.3.5 User-definable V/f characteristic

The "user-definable V/f characteristic" is provided for the individual adjustment of the motor magnetization to the actual application if linear and square-law characteristics are not suitable.

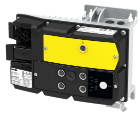
- The characteristic is defined by means of 11 parameterizable grid points (voltage/frequency values).

Parameter

Address	Name / setting range / [default setting]	Information
0x2B02:001	Frequency grid points (x) user V/f characteristic: x1 = f01 -1500 ... [**-50**] ... 1500 Hz	Freely parameterizable V/f characteristic (values for X axis). These settings define the adaptive frequency values.
0x2B02:002	Frequency grid points (x) user V/f characteristic: x2 = f02 -1500 ... [**-40**] ... 1500 Hz	
0x2B02:003	Frequency grid points (x) user V/f characteristic: x3 = f03 -1500 ... [**-30**] ... 1500 Hz	
0x2B02:004	Frequency grid points (x) user V/f characteristic: x4 = f04 -1500 ... [**-20**] ... 1500 Hz	
0x2B02:005	Frequency grid points (x) user V/f characteristic: x5 = f05 -1500 ... [**-10**] ... 1500 Hz	
0x2B02:006	Frequency grid points (x) user V/f characteristic: x6 = f06 -1500 ... [**0**] ... 1500 Hz	
0x2B02:007	Frequency grid points (x) user V/f characteristic: x7 = f07 -1500 ... [**10**] ... 1500 Hz	
0x2B02:008	Frequency grid points (x) user V/f characteristic: x8 = f08 -1500 ... [**20**] ... 1500 Hz	
0x2B02:009	Frequency grid points (x) user V/f characteristic: x9 = f09 -1500 ... [**30**] ... 1500 Hz	
0x2B02:010	Frequency grid points (x) user V/f characteristic: x10 = f10 -1500 ... [**40**] ... 1500 Hz	
0x2B02:011	Frequency grid points (x) user V/f characteristic: x11 = f11 -1500 ... [**50**] ... 1500 Hz	



Address	Name / setting range / [default setting]	Information
0x2B03:001	Voltage grid points (y) user V/f characteristic: y1 = U01 (x = f01) 0.00 ... [**400.00**] ... 5000.00 V	Freely parameterizable V/f characteristic (values for Y axis). These settings define the adaptive voltage values.
0x2B03:002	Voltage grid points (y) user V/f characteristic: y2 = U02 (x = f02) 0.00 ... [**320.00**] ... 5000.00 V	
0x2B03:003	Voltage grid points (y) user V/f characteristic: y3 = U03 (x = f03) 0.00 ... [**240.00**] ... 5000.00 V	
0x2B03:004	Voltage grid points (y) user V/f characteristic: y4 = U04 (x = f04) 0.00 ... [**160.00**] ... 5000.00 V	
0x2B03:005	Voltage grid points (y) user V/f characteristic: y5 = U05 (x = f05) 0.00 ... [**80.00**] ... 5000.00 V	
0x2B03:006	Voltage grid points (y) user V/f characteristic: y6 = U06 (x = f06) 0.00 ... [**0.00**] ... 5000.00 V	
0x2B03:007	Voltage grid points (y) user V/f characteristic: y7 = U07 (x = f07) 0.00 ... [**80.00**] ... 5000.00 V	
0x2B03:008	Voltage grid points (y) user V/f characteristic: y8 = U08 (x = f08) 0.00 ... [**160.00**] ... 5000.00 V	
0x2B03:009	Voltage grid points (y) user V/f characteristic: y9 = U09 (x = f09) 0.00 ... [**240.00**] ... 5000.00 V	
0x2B03:010	Voltage grid points (y) user V/f characteristic: y10 = U10 (x = f10) 0.00 ... [**320.00**] ... 5000.00 V	
0x2B03:011	Voltage grid points (y) user V/f characteristic: y11 = U11 (x = f11) 0.00 ... [**400.00**] ... 5000.00 V	



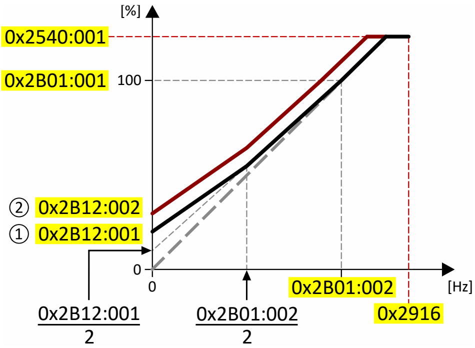
10.3.4 Set voltage boost

The parameterisable voltage boost makes it possible to improve the starting performance for applications requiring a high starting torque.

The function is equally suitable for the closed loop V/f characteristic control.

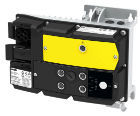
Details

- In 0x2B12:001, a permanent voltage boost can be set. ①
- In 0x2B12:002, an additional voltage boost can be set for acceleration processes ②
- Reference for the percentage setting of the voltage boost is the base voltage 0x2B01:001.



Parameter

Address	Name / setting range / [default setting]	Information
0x2B12:001	V/f voltage boost: Fixed boost 0.0 ... [**2.5**] ... 20.0 %	Constant voltage boost for V/f characteristic control without feedback. • 100 % = V/f base voltage 0x2B01:001 • For the purpose of optimizing the start behavior for applications requiring a high starting torque.
0x2B12:002	V/f voltage boost: Boost at acceleration 0.0 ... [**0.0**] ... 20.0 %	Additional voltage boost for V/f characteristic control without feedback. • 100 % = V/f base voltage 0x2B01:001 • This voltage boost is only active while the motor is accelerated. It then acts in addition to the fixed voltage boost set in 0x2B12:001.



10.3.5 Set slip compensation

The speed of an asynchronous motor decreases as load is applied. This load-dependent speed drop is called “slip”. The slip compensation serves to counteract the load-dependent speed loss.

Preconditions

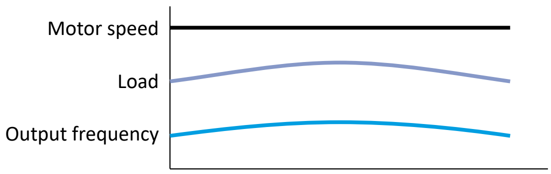
The function is only effective in the motor control type "V/f characteristic control (VFC open loop)".

In order for the function to generate the rated slip correctly the following parameters must be correctly set:

- Rated speed
- Rated frequency
- Number of pole pairs (automatically calculated from Rated speed and Rated frequency)

Details

The slip compensation increases or decreases the output frequency as a response to a load change. Thus, the slip is counteracted and the speed is kept constant.



The rated slip required for the slip compensation is calculated by the inverter according to the following formula:

Rated slip [%] = (1 - (rated motor speed [rpm] / (120 * rated motor frequency [Hz] / number of poles))) * 100

Calculation example:

- Rated motor speed = 1750 rpm
- Rated motor frequency = 60 Hz
- Number of poles = 2 * Number of pole pairs = 2 * 2 = 4
- Rated slip = (1 - (1750 / (120 * 60 / 4))) * 100 = 2.77 %

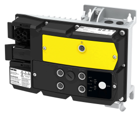
The rated slip represents the reduction of the motor speed due to the motor load. At full speed and full load, the motor given in the example would rotate with 1750 rpm, which means 2.77 % below its synchronous speed of 1800 rpm. In order to compensate for this speed loss, the inverter increases the output frequency by the rated slip multiplied by the rated motor frequency. In the example, there is an increase in the output frequency at full load of 2.77 % * 60 Hz = 1.66 Hz.

In order to take into account load changes, the influence of the rated slip on the output frequency can be adapted in 0x2B09:001. A setting of 100 % corresponds to the rated slip of the motor in the nominal operating point.

With reference to the example above and a setpoint frequency of 60 Hz:

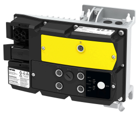
- If 0x2B09:001 = 100 %, the output frequency is = 61.66 Hz (60 Hz + 100 % * 1.66 Hz).
- If 0x2B09:001 = 50 %, the output frequency is = 60.83 Hz (60 Hz + 50 % * 1.66 Hz).

Additionally, the filter time for the slip compensation can be adapted in 0x2B09:002 if required. The preset filter time is adapted to typical motors. If full load or nearly full load oscillations or instabilities occur, we recommend an increase of the filter time.



Parameter

Address	Name / setting range / [default setting]	Information
0x2B09:001	Slip compensation: Gain -200.00 ... [**100.00**] ... 200.00 %	Adjustment in percent of the slip calculated. • For instance required for deviations of the real motor data from the nameplate data. • A setting of 100 % corresponds to the rated slip of the machine in the nominal operating point.
0x2B09:002	Slip compensation: Filter time 1 ... [**100**] ... 6000 ms	Filter time for the slip compensation. • The preset filter time is adapted to typical motors.
0x2C02:004	Motor parameter (ASM): Slip frequency • Read only: x.x Hz	Display of the rated slip determined.



10.3.6 Set oscillation damping

The oscillation damping serves to reduce the oscillations during no-load operation which are caused by energy oscillating between the mechanical system (mass inertia) and the electrical system (DC bus). Furthermore, the oscillation damping can also be used to compensate for resonances.

The function is equally suitable for the closed loop V/f characteristic control.

Restrictions

Observe the following restrictions:

- Damping is possible only for constant oscillations at a steady-state operating point.
- Oscillations occurring sporadically cannot be damped.
- Oscillation damping is not suitable for oscillations occurring during dynamic processes (e.g. accelerations or load changes).
- Oscillation damping is only active if the setpoint speed is greater than 10 rpm and the DC-bus voltage exceeds a value of 100 V.

Details

The determination of the oscillation is based on the active current. In order to obtain the alternating component of the active current, this current is differentiated. This signal is then passed through a PT1 filter.

Identification of the oscillation

Before the oscillation damping function can be parameterised, the oscillation has to be identified. One way to do this is to examine the motor current while oscillation damping is switched off (gain = 0 %). At steady-state operation, a constant current flows. If the drive oscillates, these oscillations are also visible on the motor current. It is therefore possible to determine the frequency and the amplitude of the oscillation from the alternating component of the motor current. In the following, this alternating component is referred to as "current oscillation".

Parameter setting

Set the gain of the oscillation signal according to the following equation:

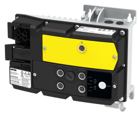
0x2B0A:001 = current amplitude * 100 % / ($\sqrt{2}$ * maximum device current)

The default time constant of the PT1 filter is sufficient for most applications. If required, it is only possible to adapt the time constant via »EASY Starter«. Generally, the time constant must be set so that the oscillation is dampened and higher-frequency components are filtered from the signal. The time constant is given by the reciprocal value of double the current oscillation frequency:

0x2B0A:002 = 1 / (2 * oscillation frequency)

Parameter

Address	Name / setting range / [default setting]	Information
0x2B0A:001	Oscillation damping: Gain -400 ... [**150**] ... 400 %	Gain of the oscillation signal. • With the setting 0, oscillation damping is deactivated.
0x2B0A:002	Oscillation damping: Filter time 1 ... [**30**] ... 600 ms	Time constant of the PT1 filter.



10.3.7 Optimising the stalling behaviour

If the motor is driven with frequencies above the rated motor frequency, the operating point is shifted to the "field weakening range". In this range, the motor voltage does not increase proportionately to the output frequency anymore. As a consequence, the inverter automatically reduces the maximum current since the full torque is not available anymore at these frequencies.

For special motors which enable an operation in the field weakening range, the behaviour in the field weakening range can be adapted to the motor with 0x2B0C.

⚠ DANGER!

Danger by incorrect parameterisation.

Possible consequences: Death, severe injuries or damage to property

- Only change the default setting (0 Hz) in 0x2B0C after consulting the motor manufacturer!
- Recommendation: Maintain default setting (0 Hz).

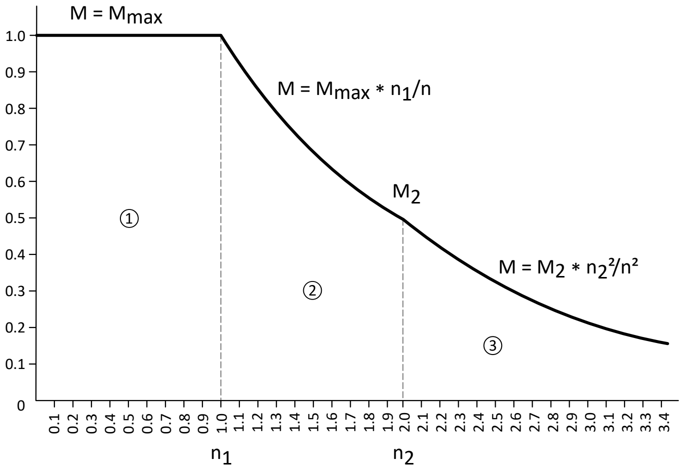
ℹ The function is equally suitable for the closed loop V/f characteristic control.

Details

The operating range of an asynchronous motor consists of the voltage range ① and the field weakening range. The field weakening range is divided into two ranges:

- In the first range ②, the power can be kept constant without the motor stalling.
- The second field weakening range ③ is characterised by the fact that the maximum permissible stator current is decreased to prevent the motor from stalling .

Speed/torque curve of the asynchronous motor with two field weakening ranges



The override point (n_2, M_2) can be influenced with 0x2B0C.

0x2B0C > 0 Hz:

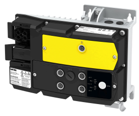
- The maximum current characteristic is shifted to higher field frequencies by the frequency entered.
- The maximum permissible current and the maximum torque increase in the field weakening range.
- The risk of motor stalling increases.

0x2B0C < 0 Hz:

- The maximum current characteristic is shifted to lower field frequencies by the frequency entered.
- The maximum permissible current and the maximum torque are reduced in the field weakening range.
- The risk of motor stalling is reduced.

Parameter

Address	Name / setting range / [default setting]	Information
0x2B0C	Override field weakening -599.0 ... [**-40.0**] ... 599.0 Hz	Offset of the override point for field weakening.



10.3.8 Torque limitation setting

Intro

For torque limitation in VFC mode, a maximum torque can be set for the inverter. If the motor torque exceeds the torque limit, the inverter modifies the output frequency to counteract this exceedance.

The quality of the torque limitation depends on the accuracy of the actual torque calculation.

Preconditions

The VFC torque limiter is only effective for the following motor control types:

- V/f control (open loop)
- V/f control (closed loop)

In order to achieve good performance, it is recommended that the motor/inverter first be identified!

▸ Options for optimizing the control loops 📖 161

Details

The VFC torque limiter becomes active in V/f operation when the current motor torque exceeds the maximum torque. The limiter modifies the output frequency to counteract the exceedance.

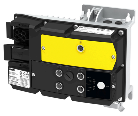
The VFC torque limitation functions in a manner similar to the VFC Imax controller, but instead of the total current, the actual torque is taken into account.

When the maximum torque is exceeded:

- During motor operation, the VFC torque limiter reduces the output frequency.
- During generator operation, the VFC torque limiter increases the output frequency.

Parameter

Address	Name / setting range / [default setting]	Information
0x2B10:001	V/f torque limitation: Gain 0.00 ... [**0.00**] ... 655.35 %	Gain of the torque limitation. • 0%: torque limitation is deactivated (standard setting) • 100%: same dynamic behaviour as the Imax controller (recommended setting for VFC torque activation)



10.3.9 Flying restart circuit

The flying restart function makes it possible to restart a coasting motor on the fly during operation without speed feedback. Synchronicity between the inverter and the motor is coordinated so that the transition to the rotating drive is effected without jerk at the time of connection.

Prerequisites:

- Drive systems with speed feedback do not need a flying restart circuit because there is always a jerk-free synchronization to the feedback speed.
- The flying restart circuit operates safely and reliably in case of drives with high centrifugal masses. If several motors with different centrifugal masses are connected to the inverter, the flying restart circuit must not be used.
- The flying restart circuit serves to identify rotating field frequencies of up to ±200 Hz.
- Overvoltage in the DC bus can occur for a short time, especially with high power, very large mass inertias and mains voltages greater than 440 V.

Required settings before the flying restart circuit is used:

1. The motor data must be set correctly. ▸ Motor data 📖 46
2. The settings for the current controller and the flying restart controller must be adapted to the motor. The settings are made automatically if one of the following optimizations is carried out:

▸ Select motor from motor catalog 📖 47

▸ Automatic motor identification (energized) 📖 163

▸ Automatic motor calibration (non-energized) 📖 164

Details

The inverter determines synchronicity by identifying the synchronous rotating field frequency. The "search" starts in the positive direction.

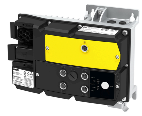
Duration:

- The flying restart process is determined within approx. 0.5 ... 1.5 seconds.
- The duration is influenced by the start frequency 0x2BA1:001.

Setting the function:

1. As start behavior, set the selection "Flying restart circuit [2]" in 0x2838:001.
   - Thus, every inverter enable causes a synchronisation to the rotating or standing motor.
   - After the inverter has been enabled, the motor can temporarily start or reverse if drives with low friction and low mass inertia are used.
   - If the inverter is operated with the default settings, no further settings are required for most applications.
2. If required, adapt the current 0x2BA1:001 and the start frequency 0x2BA1:002 for the flying restart circuit.
   - Setting notes can be found in the "Info" column for the respective parameter.

For diagnostic purposes, the frequency detected when the motor has been restarted on the fly is displayed in 0x2BA1:008.



Parameter

Address	Name / setting range / [default setting]	Information
0x2BA1:001	Flying restart circuit: Current 0 ... [**30**] ... 100 %	The current set here is injected into the motor during the flying restart process for the identification of the rotating field frequency. • 100 % = Rated motor current 0x6075 • Reducing the current causes a reduction of the motor torque during the flying restart process. A short-time starting action or reversing of the motor is prevented with low flying restart currents. • If the current is set too low, the rotating field frequency cannot be identified correctly. • If the current is increased, this improves the robustness of the flying restart circuit. • In case of high mass inertias and high speeds, the flying restart circuit may cause an overvoltage in the DC bus if no brake resistor is connected. In this case, the current must be reduced.
0x2BA1:002	Flying restart circuit: Start frequency -599.0 ... [**20.0**] ... 599.0 Hz	The frequency set here defines the starting point for the flying restart process. • The search starts in positive direction. • The default setting is adjusted to standard asynchronous motors. • In case of systems with a known search speed (e.g. torque-controlled drive systems that are to synchronise to a defined speed), the start frequency can be adapted for reducing the flying restart time.
0x2BA1:008	Flying restart circuit: Flying restart frequency • Read only: x.x Hz	Display of the found frequency at which the motor has been successfully restarted on the fly.

10.3.10 Additive voltage impression

This function serves to boost (or lower) the motor voltage from the process via an additive voltage setpoint in order to realise a load adjustment (for instance in case of winder applications).

> The function is equally suitable for the closed loop V/f characteristic control.

NOTICE

A too high boost of the motor voltage may cause the motor to heat up strongly due to the resulting current.

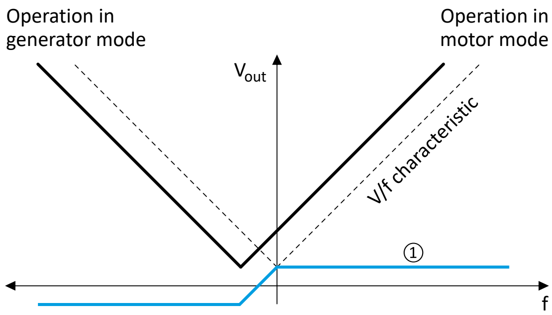
▶ Avoid a too high boost of the motor voltage!

Details

At a constant field frequency, the output voltage of the inverter can be changed within a wide range.

Example: Adaptation of the voltage characteristic in case of V/f characteristic control as a function of the load:

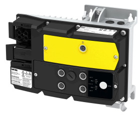
- Forward (CW) is operation in motor mode: Boost voltage.
- Reverse (CCW) is operation in generator mode: Lower voltage.



① Selecting an additive voltage setpoint

Parameter

Address	Name / setting range / [default setting]		Information
0x2B13:001	Additive voltage impression: Enable Function		1 = enable function.
	0	**Disable**	
	1	Enable	
0x2B13:002	Additive voltage impression: Setpoint source		Selection of the source for specifying the additive voltage setpoint. • 100 % = Rated voltage 0x2C01:007
	3	**Network**	The additive voltage setpoint is defined via the mappable NetWordIN5 0x4008:005data word.
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 📖 406
	231	Scaling2 value	

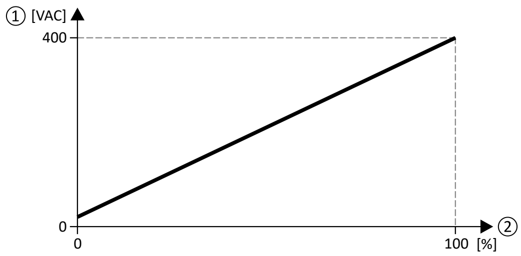


Address	Name / setting range / [default setting]	Information
0x2B13:003	Additive voltage impression: Actual voltage • Read only: x V	Display of the current (boosted or lowered) voltage.
0x2B13:004	Additive voltage impression: Ramp time 0.0 ... [**0.0**] ... 3600.0 s	Ramp time for ramping up the required additive voltage setpoint. • The ramp time is effective after each activation of the inverter. • The ramp time refers to the rated voltage 0x2C01:007.

Example: Using the function with a 400-V inverter

With the settings indicated below, the motor is accelerated after the start to 50 Hz. As the base frequency, however, is set very high (here: 599 Hz), the motor voltage at 50 Hz only amounts to 20 VAC.

Now, the network serves to change the motor voltage at constant frequency within a wide range:



① Motor voltage

② Selection of an additive voltage setpoint in percent via network

Parameter	Designation	Setting for this example
0x2860:001	Frequency control: Default setpoint source	Frequency preset 1 [11]
0x2911:001	Frequency setpoint presets: Preset 1	50 Hz
0x2B01:002	V/f shape data: Base frequency	599 Hz
0x2B13:001	Additive voltage impression: Enable Function	Enable [1]
0x2B13:002	Additive voltage impression: Setpoint source	Network [3]

10.4 V/f characteristic control for asynchronous motor (VFC closed loop)

The V/f characteristic control with feedback (VFC closed loop) can be used if an asynchronous motor with motor encoder is connected to the inverter.

The speed feedback leads to the following advantages:

- Stationary speed accuracy
- Improved dynamics compared to the V/f characteristic control without feedback (VFC open loop) and to the encoderless vector control (SLVC)

Preconditions

- The V/f characteristic control (VFC closed loop) is only suitable for asynchronous motors.
- The V/f characteristic control (VFC closed loop) requires a feedback of the speed. A motor encoder must be connected to the inverter and set as feedback system for the motor control.
  - This setting is not made automatically if a motor is selected from the motor catalog.
  - For required settings see chapter "Configure encoder input". 110
- If you actuate a drive with a square-law V/f characteristic: check whether the corresponding drive is suitable for operation with a square-law V/f characteristic!
- From the motor nameplate data, at least the rated speed and rated frequency must be entered, so that the inverter can calculate the correct number of pole pairs. ▸ Motor data 46

NOTICE

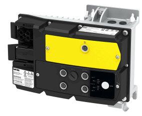
Motor damage!

Operating the motor above the rated motor frequency/rated voltage will lead to damage to the motor.

▸ Only operate above the rated motor frequency / rated voltage with the permission of the motor manufacturer.

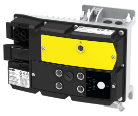
Details

- 0x2B00 provides different characteristic shapes.
- Limiting factors for the V/f characteristic are the rated mains voltage 0x2540:001, the minimum frequency 0x2915 and the maximum frequency 0x2916.
- The slip compensation is deactivated in this motor control type. In case of V/f characteristic control with feedback, the slip is calculated and injected by the slip controller. ▸ Slip controller 174
- For more details, see the description of the motor control type:
  - "V/f characteristic control for asynchronous motor (VFC open loop)" 118
  - "Set voltage boost" 126



10.4.1 Required commissioning steps

1. Configuring the feedback system 🕮 109
2. Activate motor control type: 0x2C00 = "V/f characteristic control (VFC closed loop) [7]".
3. Set limiting factors for the V/f characteristic:
   1. Rated mains voltage 0x2540:001
   2. Minimum frequency 0x2915
   3. Maximum frequency 0x2916
4. Set V/f characteristic data:
   1. Base voltage 0x2B01:001
   2. Base frequency 0x2B01:002
5. Select a characteristic shape suitable for the application in 0x2B00.
6. Optional settings:
   - Set voltage boost 🕮 126
   - Set oscillation damping 🕮 129
   - Optimising the stalling behaviour 🕮 130
   - Additive voltage impression 🕮 135
   - Slip controller 🕮 174
7. Optional: carry out optimisation of the control circuits.
   - A optimisation of the control loops is not mandatory for this motor control type but may lead to a better control mode.
   - Details: ▶ Options for optimizing the control loops 🕮 161



10.5 Sensorless control for synchronous motor (SLSM-PSM)

The sensorless control for synchronous motors is based on a decoupled, separated control of the torque-producing current and the current aligned with the field. In contrast to the servo control with position encoder, the actual speed value and rotor position are reconstructed via a motor model.

Details

The operating behavior of sensorless control for synchronous motors is divided into two areas due to its principle:

- Low speed range: An unobservable range of low speeds.
- High speed range: Range with high speeds in which the rotor position can be calculated for field-oriented control by means of an observer.

The motor model-based approach to control includes two different methods for the low-speed range:

- Low-speed method 0x2C13 = "Carrier based [1]"
  - This method is not suitable for all permanently excited synchronous motors!
    The position detection requires an anisotropy in the inductors of the motor. From approx. 5 % difference between the inductance Ld (0x2C03:005) and the inductance Lq (0x2C03:006) this method can be used.
  - Permanently excited synchronous motors with buried magnets and distributed stator winding are particularly suitable. Permanently excited synchronous motors with concentrated windings tend to be less suitable.
  - With this method, a high-frequency carrier signal is applied in the low-speed range ("HF injection"). With this active method it is possible to detect the rotor position and to operate the motor speed controlled. This results in a higher starting torque with lower power consumption. The control is field oriented.

> Motor phase failure detection is deactivated if HF injection is active in the low-speed range.

- Low-speed method 0x2C13 = "i/f based [2]"
  - This method is suitable for all permanently excited synchronous motors.
  - With this method, a controlled start-up occurs in the low-speed range.

Behavior in the high-speed range

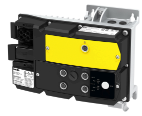
- In the high-speed range (setpoint speed| > lower limit 0x2C11:001 or (|actual speed| > 0x2C10:008) the rotor flux position and the speed is reconstructed by means of observation.
- The control is field oriented. Only the current required for generating the necessary torque is injected.

Pole position identification (PPI)

- For controlling a permanent-magnet synchronous motor, the pole position - the angle between the motor phase U and the field axis of the rotor - must be known.
- If the drive is at standstill, the "pole position identification (PPI)" function is immediately activated after the inverter is enabled. ▶ Synchronous motor: Pole position identification (PPI) 📖 112

Flying restart circuit

- A flying restart circuit for the synchronous motor up to the rated speed is supported.
- If the flying restart circuit is to be used, set the start method "Flying restart circuit [2]" in 0x2838:001. Additional settings are not required for the flying restart circuit in the case of a sensorless control of a synchronous motor.



10.5.1 Required commissioning steps

1. Activate motor control type: 0x2C00 = "Sensorless control for synchronous motors (SLSM-PSM) [8]".
2. Automatic motor identification (energized) 📖 163
   - **Mandatory for this motor control mode in order to determine the equivalent circuit data and calculate the parameters for encoderless operation with HF injection.**
3. Optionally for a speed control with torque limitation in operating mode 0x6060 = "MS: Velocity mode [-2]":
   - Select the source in 0x2949:001 for the positive torque limit source and set it accordingly.
   - Select the source in 0x2949:002 for the negative torque limit source and set it accordingly.
4. Optionally for a speed control with torque limitation in operating mode 0x6060 = "CiA: Velocity mode (vl) [2]":
   - Set the positive torque limit in 0x60E0
   - Set the negative torque limit in 0x60E1.

10.5.2 Stalling protection

The stalling monitoring for the sensorless control of synchronous motors (SLSM-PSM) switches off the drive if the motor is about to "stall". A possible cause may be an overload of the motor.

Preconditions

The stalling monitoring only works in the controlled area and if the motor is not operated in the field weakening range.

Details

In order to detect the motor stalling, the cosine phi is used.

Example:

- For the cosine phi, the value "0.9" is set in 0x2C01:008 according to the data given on the motor nameplate.
- The limit value for stalling monitoring is set in 0x2C11:006 to "80 %".
- Stalling monitoring is triggered if the current cosine phi is lower than 0.72 (80 % of 0.9).

If stalling monitoring is triggered, the "Trouble" error response takes place. If the operating mode "MS: Velocity mode [-2]" is set in 0x6060, the motor automatically restarts if the trouble does not exist any more.

Parameter

Address	Name / setting range / [default setting]	Information
0x2C11:006	High speed range: Stall monitoring limit 0 ... [**50**] ... 65535 %	The stall monitoring limit refers to the cosine phi of the motor in percent.

10.5.3 Expert settings

For the motor model-based approach to control, two different methods are available for the low-speed range in 0x2C13.

Low-speed method 0x2C13 = "Carrier based [1]"

- In the unobservable range of low speeds (|actual speed| < 0x2C10:008), a high-frequency carrier signal is switched on ("HF injection").
- The amplitude of this carrier signal is set in 0x2C10:001. Larger values lead to better position detection. If the value is set too small, then the amplitude of the carrier signal is automatically increased after controller release. This ensures that HF injection always works regardless of the setting in 0x2C10:001.
- The two parameters 0x2C10:001 and 0x2C10:008 can be identified automatically or set manually. The settings for the two parameters are not provided by the motor catalog!

Low-speed method 0x2C13 = "i/f based [2]"

- A controlled start-up takes place when |setpoint speed| < lower limit 0x2C11:001.
- During the acceleration phase, the 0x2C12:001 and 0x2C12:002 current setpoints are added and impressed on the motor.
- This method is suitable for all permanently excited synchronous motors.

NOTICE

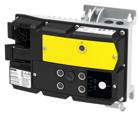
With the Low-Speed method 0x2C13 = "i/f based [2]", an adjustable constant current is impressed in the lower speed range. If this current is higher than the rated motor current, the motor may heat up in the lower speed range. This effect increases if the motor is operated in the lower speed range for a longer period of time.

Possible consequences: Irreversible damage of the motor

- ▶ Do not operate the motor for a longer period of time in the lower speed range.
- ▶ For detecting and monitoring the motor temperature, we recommend a temperature feedback via PTC thermistor or thermal contact. ▶ Motor temperature monitoring 📖 180

Parameter

Address	Name / setting range / [default setting]		Information
0x2C13	SLSM-PSM low speed method • Setting can only be changed if the inverter is disabled.		Selection of the method for the lower speed range in sensorless control for synchronous motor (SLSM-PSM).
	1	Carrier based	Encoderless operation with HF injection. Not suitable for MCS motors!
	2	i/f based	Encoderless operation with controlled start-up. Universally suitable for all motors. Note! With this low-speed method, the set torque limits are only active in the higher speed range (closed-loop mode)!
0x2C10:001	Low speed range: HF amplitude 0.0 ... [**50.0**] ... 400.0 V		Setting of the HF amplitude for low speed method "Carrier based".
0x2C10:008	Low speed range: HF injection range 0.5 ... [**6.0**] ... 50.0 %		Setting of the speed range with HF injection for low speed method "Carrier based".
0x2C11:001	High speed range: Lower limit 1 ... [**10**] ... 100 %		Definition of the lower limit of the high speed range. • The lower limit has a permanent hysteresis of 5 %.
0x2C12:001	SM low speed range: Acceleration current 5 ... [**70**] ... 400 %		R.m.s. current value for acceleration processes in the lower velocity range. • 100 % = Rated motor current (0x6075) • In the lower speed range and during the acceleration phase, the current setpoints of 0x2C12:001 and 0x2C12:002 are added and injected to the motor.



Address	Name / setting range / [default setting]	Information
0x2C12:002	SM low speed range: Standstill current 0 ... [**30**] ... 400 %	R.m.s. current value for processes without acceleration (for instance standstill or constant setpoint speed) in the lower velocity range. • 100 % = Rated motor current (0x6075) • In the lower speed range and during the acceleration phase, the current setpoints of 0x2C12:001 and 0x2C12:002 are added and injected to the motor. Note! At the "100 %" setting, a motor current flows at standstill and at constant speed. The r.m.s. value of this motor current is greater than the rated motor current by a factor of sqrt(2) at standstill. The reason for this is that a DC current is injected into the synchronous motor at a standstill. The correct rated motor current flows when the motor turns.

10.6 Parameterisable motor functions

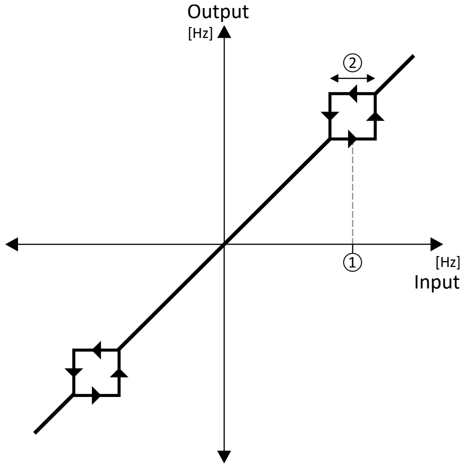
10.6.1 Skip frequencies

By means of the three parameterisable skip frequencies, critical frequencies can be suppressed which lead to mechanical resonances in the system.

Details

A blocking zone is active as soon as the frequency for this blocking zone is set to a value ≠ "0 Hz".

- The frequency defines the center of the range to be masked out. ①
- The bandwidth defines its total size. ②



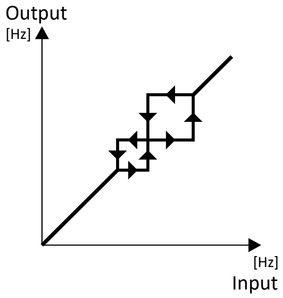
Example: For a blocking zone, the frequency is set to 20 Hz and the bandwidth to 10 Hz. These settings mask out the range from 15 Hz to 25 Hz.

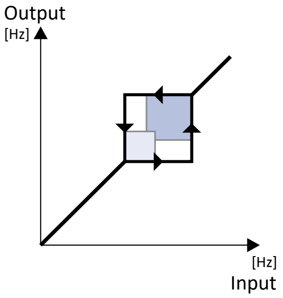
Notes:

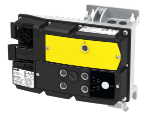
- Skip frequencies are absolute values. With the setting "20 Hz", at the same time also the skip frequency "-20 Hz" is defined.
- The inverter accelerates/decelerates the motor through the range to be masked out. Continuous operation within this range is not possible.
- A blocking zone is not active if its bandwidth is set to "0 Hz".

Adjacent and overlapping areas:

- Example on the left: If the ranges are closely spaced, the ranges are passed through as shown.
- Example on the right: If the ranges overlap, the lowest and highest value form a new range. In the status display 0x291F:016, both ranges are shown as active.

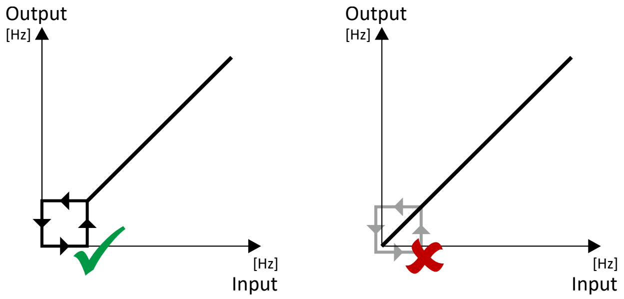






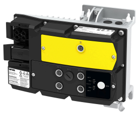
Valid and invalid ranges:

- Example on the left: Skip frequency = 5 Hz, bandwidth = 10 Hz
  → Valid range (starts at ≥ 0)
- Example on the right: Skip frequency = 4 Hz, bandwidth = 10 Hz
  → Invalid range (starts at < 0); is thus ignored.



Parameter

Address	Name / setting range / [default setting]	Information
0x291F:001	Skip frequencies: Skip frequency 1 0.0 ... [**0.0**] ... 1000.0 Hz	Center of frequency range 1 which is to be skipped.
0x291F:002	Skip frequencies: Skip bandwidth 1 0.0 ... [**0.0**] ... 10.0 Hz	Size of frequency range 1 which is to be skipped.
0x291F:003	Skip frequencies: Skip frequency 2 0.0 ... [**0.0**] ... 599.0 Hz	Center of frequency range 2 which is to be skipped.
0x291F:004	Skip frequencies: Skip bandwidth 2 0.0 ... [**0.0**] ... 10.0 Hz	Size of frequency range 2 which is to be skipped.
0x291F:005	Skip frequencies: Skip frequency 3 0.0 ... [**0.0**] ... 1000.0 Hz	Center of frequency range 3 which is to be skipped.
0x291F:006	Skip frequencies: Skip bandwidth 3 0.0 ... [**0.0**] ... 10.0 Hz	Size of frequency range 3 which is to be skipped.
0x291F:016	Skip frequencies: Status • Read only Bit 0 Blocking zone 1 active Bit 1 Blocking zone 2 active Bit 2 Blocking zone 3 active Bit 4 Frequency above blocking zone 1 Bit 5 Frequency above blocking zone 2 Bit 6 Frequency above blocking zone 3 Bit 8 Blocking zone 1 invalid Bit 9 Blocking zone 2 invalid Bit 10 Blocking zone 3 invalid	Bit-coded status display of the skip frequencies.
0x291F:032	Skip frequencies: Input frequency • Read only: x.xx Hz	Display of the skip filter input frequency.
0x291F:033	Skip frequencies: Output frequency • Read only: x.xx Hz	Display of the skip filter output frequency.



10.6.2 DC braking

The "DC braking" function generates a braking torque by injecting a DC current into the motor. The function can be used to shorten the braking of a load with high mass inertia. Another application is holding the motor shaft before starting or while stopping.

NOTICE

Avoid long-time activation of the "DC braking" function with a high braking current or a high braking voltage!

Possible consequences: thermal motor overload

- Only use the "DC braking" function with applications in which the load is only occasionally stopped.
- Do not activate the "DC braking" function longer than necessary.

Preconditions

The "DC braking" function can only be activated if the inverter is enabled.

This function is not available for the SL-PSM motor control mode 0x2C00.

Details

The function can be used as follows:

1. Automatically when the motor is started.
2. Automatically when the motor is stopped.
3. Manually (via the flexible I/O configuration).

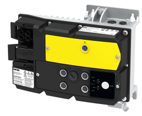
The three options can also be combined, for instance automatic DC braking when starting and stopping the motor.

For further details and configuration examples, see the following subchapter:

- Example: Automatic DC braking when starting the motor 146
- Example: Automatic DC braking when stopping the motor 147
- Activating DC braking manually 149
- Migration of Lenze Inverter Drives 8200/8400 151

Parameter

Address	Name / setting range / [default setting]	Information
0x2B84:001	DC braking: Current 0.0 ... [**0.0**] ... 200.0 %	Braking current for DC braking. • 100 % = Rated motor current 0x6075
0x2B84:002	DC braking: Automatic hold time 0.0 ... [**0.0**] ... 1000.0 s	Hold time for automatic DC braking. • The "Automatic DC braking" function is active for the time set here. • 1000.0 = infinite Note! Do not set this parameter to the value "1000.0" (infinite) if the DC braking is used during the start. The "Infinite" setting can be used to lock the rotor for an indefinite time while a stop is active. However, ensure here that the longer DC braking does not cause a thermal overload of the motor!
0x2B84:003	DC braking: Automatic operating threshold 0.0 ... [**0.0**] ... 599.0 Hz	Operating threshold for automatic DC braking. • With the setting 0, the "Automatic DC braking" function is deactivated.
0x2B84:004	DC braking: Demagnetization time 0 ... [**100**] ... 150 %	In the default setting, the DC braking is activated after the standard demagnetising time has elapsed. This parameter can be used to adapt the time. • 100 % = Default demagnetization time 0x2B84:005 Note! A too short demagnetising time can cause an overcurrent error!



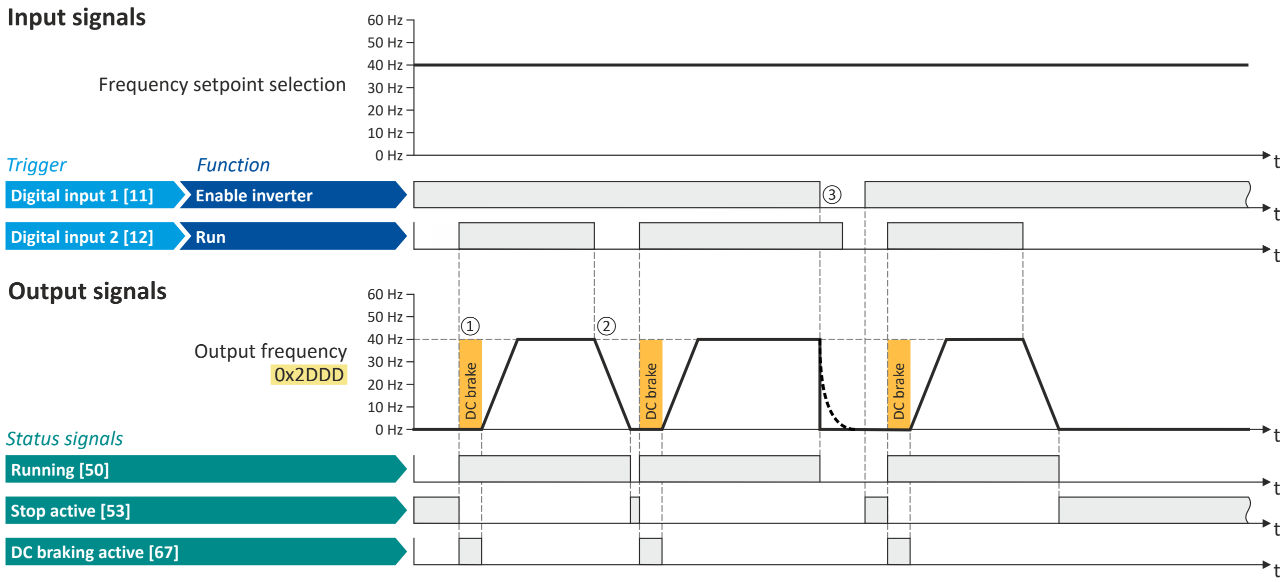
Address	Name / setting range / [default setting]		Information
0x2B84:005	DC braking: Default demagnetization time • Read only: x ms		Display of the standard demagnetising time as a setting help for the user. • This time is calculated by the inverter: Demagnetising time = 7 * rotor time constant
0x2B84:006	DC braking: Inverter disable		1 = behaviour in case of automatic DC braking as with the Lenze Inverter Drives 8200/8400. The behaviour of the Lenze Inverter Drives 8200/8400 in case of automatic DC braking is different: In case of these inverters, after the auto DCB hold time has elapsed, the motor is deenergised (by means of pulse inhibit) until the setpoint exceeds th auto DCB operating threshold. In order to make a migration to the i500 inverter series easier, the setting "1" serves to activate the same behaviour in the i500.
	0	**Disabled**	
	1	Activated	

10.6.2.1 Example: Automatic DC braking when starting the motor

In order that the DC braking is automatically active when the motor is started, the start method "DC braking [1]" must be set in 0x2838:001.

- The DC braking is carried out with the braking current set in 0x2B84:001.
- Only after the hold time 0x2B84:002 has elapsed, the motor is accelerated to the setpoint.

Parameter	Designation	Setting for this example
0x2631:001	Enable inverter	Digital input 1 [11]
0x2631:002	Run	Digital input 2 [12]
0x2631:004	Reset fault	Not connected [0]
0x2838:001	Start method	DC braking [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 1 [11]
0x2911:001	Frequency setpoint presets: Preset 1	40 Hz
0x2B84:001	Current	50 %
0x2B84:002	Automatic hold time	10 s



The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

① After the start command, the DC braking is active. Only after the hold time 0x2B84:002 has elapsed, the motor is accelerated to the setpoint.
② The motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp.
③ If the inverter is disabled, the motor coasts.

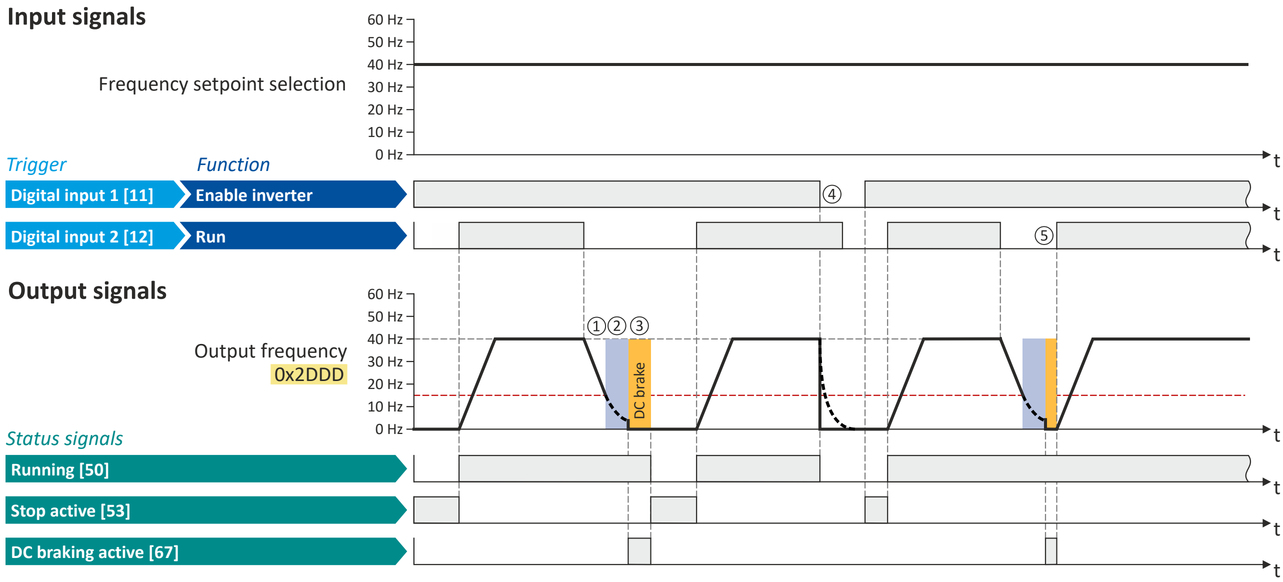
10.6.2.2 Example: Automatic DC braking when stopping the motor

In order that the DC braking is automatically active when the motor is stopped, the corresponding operating threshold must be set in 0x2B84:003.

- After a stop command, the motor is first decelerated as set. Once the output frequency falls below the set operating threshold, the inverter stops the deceleration and activates DC braking.
- DC braking is carried out with the braking current set in 0x2B84:001 for the hold time set in 0x2B84:002.
- The exact behavior depends on the stop method set in 0x2838:003.

Stop method = "Standard ramp [1]"

Parameter	Name	Setting for this example
0x2631:001	Enable inverter	Digital input 1 [11]
0x2631:002	Run	Digital input 2 [12]
0x2631:004	Reset fault	Not connected [0]
0x2838:003	Stop method	Standard ramp [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 1 [11]
0x2911:001	Frequency setpoint presets: Preset 1	40 Hz
0x2B84:001	Current	50%
0x2B84:002	Automatic hold time	10 s
0x2B84:003	Automatic operating threshold	15 Hz



The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

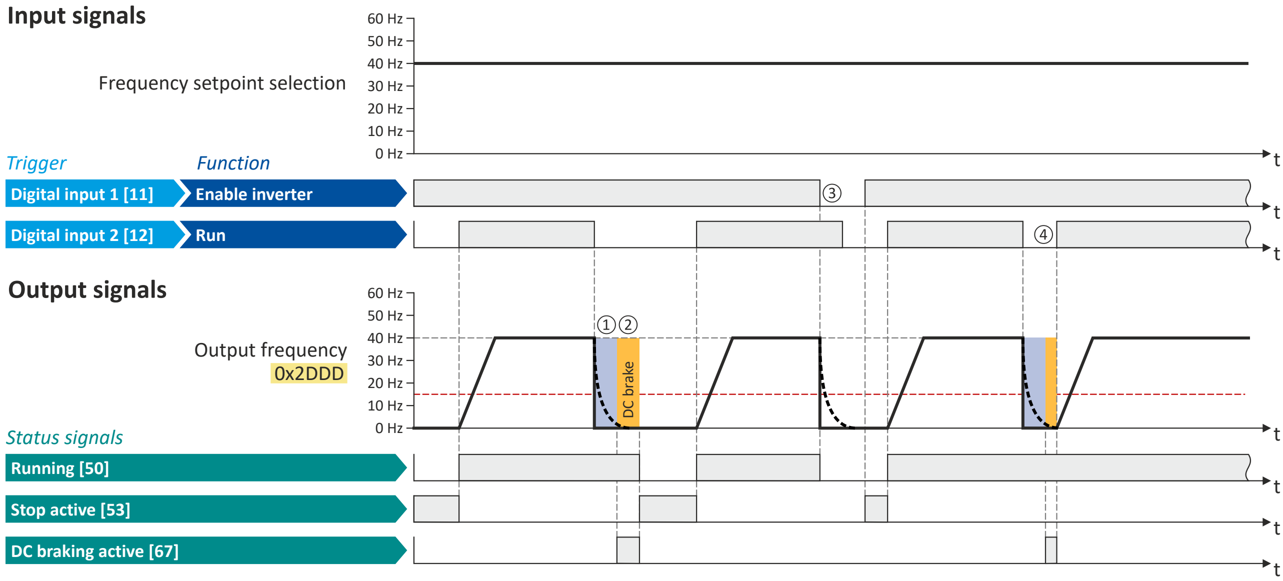
① With the stop method "Standard ramp [1]", the motor is first decelerated normally until the value falls below the operating threshold set in 0x2B84:003.
② The motor coasts down for a specified time. This "demagnetizing time" serves to reduce the induced voltage.
③ The DC braking becomes active for the hold time set in 0x2B84:002.
④ If the inverter is disabled, the motor coasts. (DC braking is only possible if the inverter is enabled).
⑤ If there is a new start command within the hold time, the DC braking is cancelled. The motor is accelerated to the setpoint again.

Stop method = "Quick stop ramp [2]"

Same behavior as with the stop method "Standard ramp [1]", except that the motor is decelerated with the quick stop ramp instead of the standard ramp.

Stop method = "Coasting [0]"

Parameter	Name	Setting for this example
0x2631:001	Enable inverter	Digital input 1 [11]
0x2631:002	Run	Digital input 2 [12]
0x2838:003	Stop method	Coasting [0]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 1 [11]
0x2911:001	Frequency setpoint presets: Preset 1	40 Hz
0x2B84:001	Current	50%
0x2B84:002	Automatic hold time	10 s
0x2B84:003	Automatic operating threshold	15 Hz



The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

① With the stop method "Coasting [0]", the motor first coasts down for a specified time. This "demagnetizing time" serves to reduce the induced voltage.
② The DC braking becomes active for the hold time set in 0x2B84:002.
③ If the inverter is disabled, the motor coasts. (DC braking is only possible if the inverter is enabled).
④ If there is a new start command within the hold time, the DC braking is cancelled. The motor is accelerated to the setpoint again.

10.6.2.3 Activating DC braking manually

By means of the "Activate DC braking" function, DC braking can be activated manually.

Preconditions

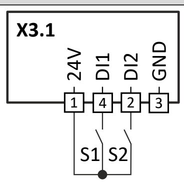
The current for DC braking must be set > 0 % so that the function can be executed.

Parameter

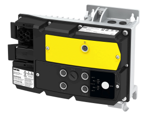
Address	Name / setting range / [default setting]	Information
0x2631:005	Function list: Activate DC braking • Further possible settings: ▸ Trigger list 🕮 58	Assignment of a trigger for the "Activate DC braking" function. Trigger = TRUE: Activate DC braking. Trigger = FALSE: Deactivate DC braking. ⚠ CAUTION! DC braking remains active as long as the trigger is set to TRUE. ▸ DC braking 🕮 145
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).

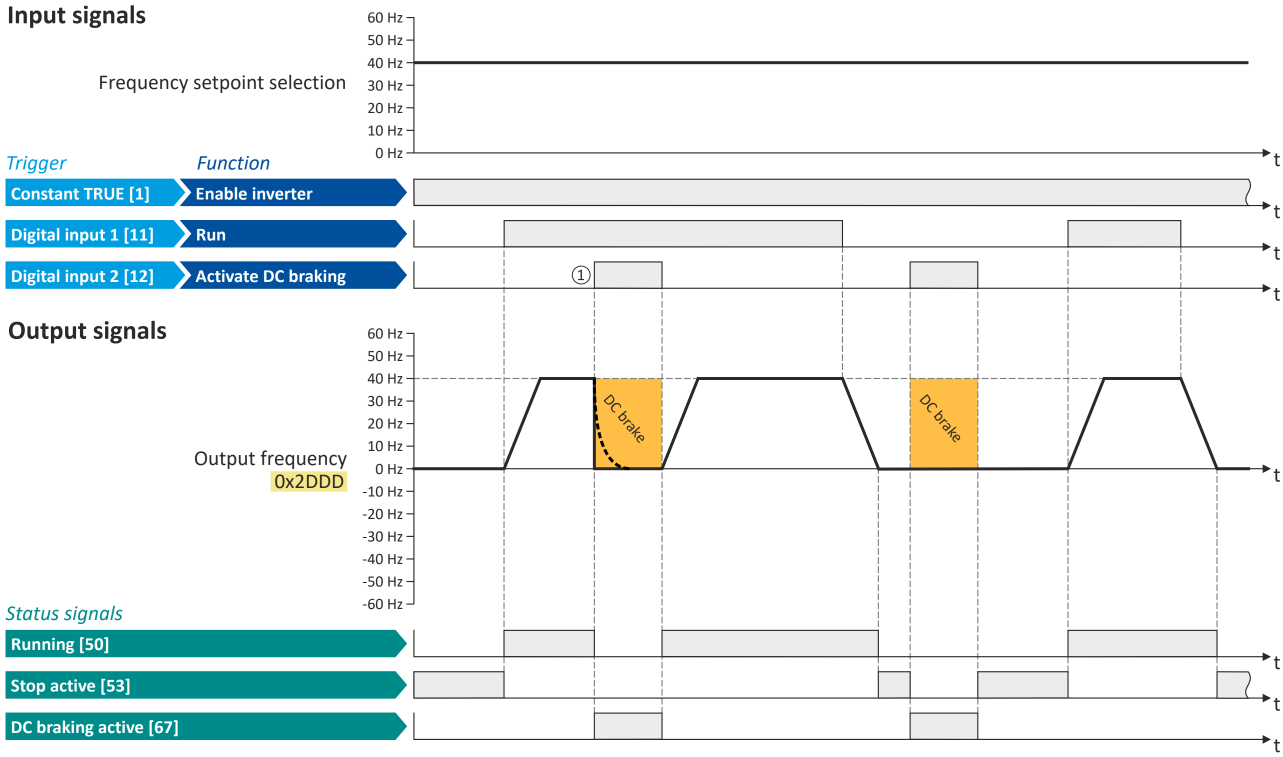
Example for operating mode

- Switch S1 starts the motor in forward direction of rotation. Switch S1 in initial position stops the motor again.
- Switch S2 activates DC braking.

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Activate DC braking

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:005	Activate DC braking	Digital input 2 [12]
0x2838:003	Stop method	Standard ramp [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz
0x2B84:001	DC braking: Current	10%





The status signals can be assigned to digital outputs. ▸ Configure digital outputs 📖 194

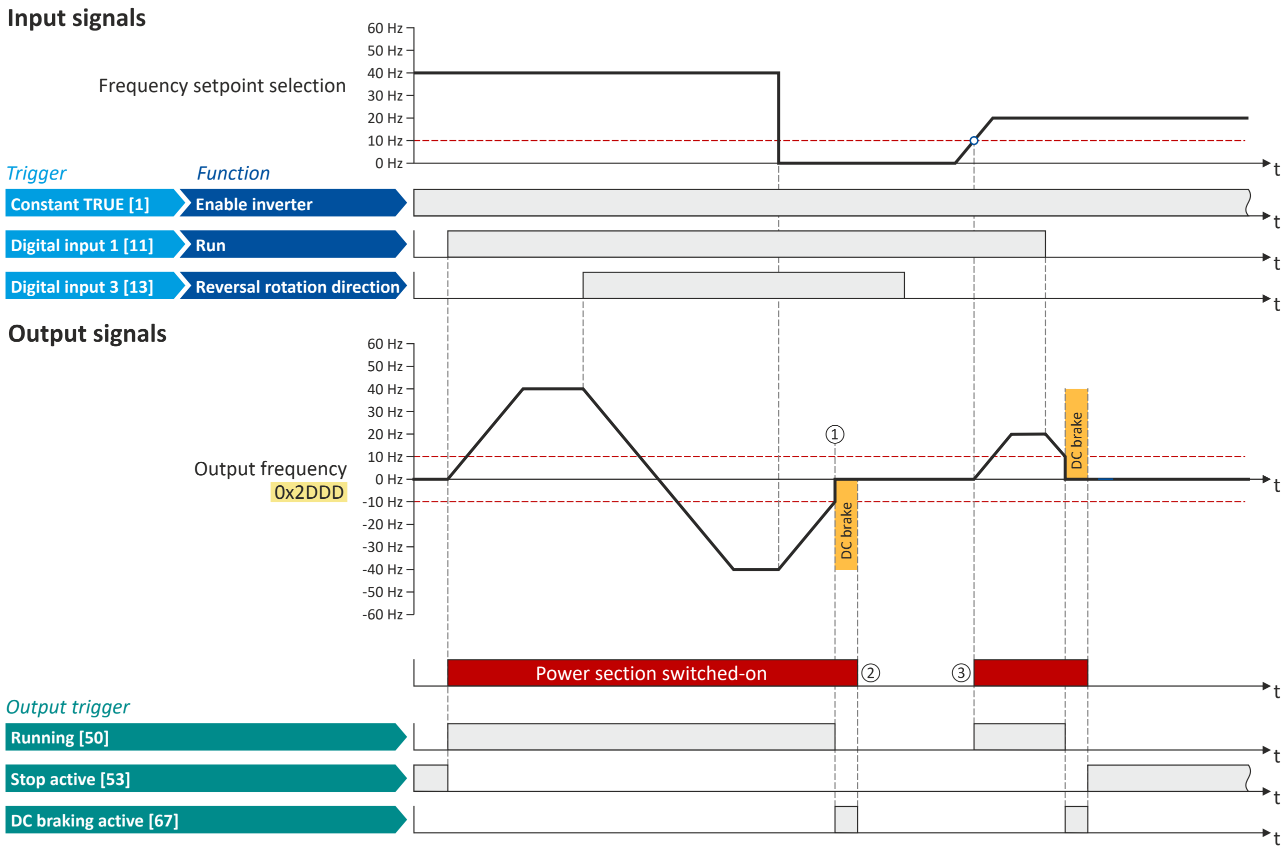
① If DC braking is activated while the motor is running, the output pulses of the inverter are disabled immediately. For stopping the motor, the current set in 0x2B84:001 is injected. The exact drive behavior depends on the settings for the "DC braking" function and the load properties.

10.6.2.4 Migration of Lenze Inverter Drives 8200/8400

The behavior of the Lenze Inverter Drives 8200/8400 in case of automatic DC braking is different: In case of these inverters, after the auto DCB hold time has elapsed, the motor is deenergized (by means of pulse inhibit) until the setpoint exceeds the auto DCB operating threshold. In order to make a migration to the i500 inverter series easier, the setting 0x2B84:006 = "1" serves to activate the same behavior in the i500.

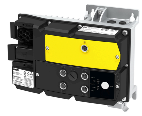
The following example illustrates the behavior of the function if 0x2B84:006 = "1".

Parameter	Name	Setting for this example
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:013	Reverse rotational direction	Digital input 3 [13]
0x2838:003	Stop method	Standard ramp [1]
0x2B84:001	Current	50%
0x2B84:002	Automatic hold time	10 s
0x2B84:003	Automatic operating threshold	10 Hz
0x2B84:006	Inverter disable	1



The status signals can be assigned to digital outputs. ▸ Configure digital outputs 🕮 194

① If the setpoint falls below the operating threshold set in 0x2B84:003, the DC braking gets active for the hold time set in 0x2B84:002.
② After the hold time has elapsed, the power section is switched off.
③ If the setpoint exceeds the operating threshold again, the power section is switched on again. The motor is accelerated to the setpoint again.



10.6.3 Holding brake control

This function serves as a low-wear control of a holding brake. The holding is usually mounted to the motor as an option. The holding brake can be automatically released via the start command for the inverter or manually via an external control signal, for instance, by a higher-level Controller. The interaction of higher-level Controller and holding brake is especially important for vertical applications. Horizontal applications need a less demanding holding brake control.

Preconditions

- Observe that the holding brake is an important element of the machine's safety concept as a whole. Therefore be sure to carry out commissioning of this system part with particular care!
- Holding brakes are not intended for braking during operation. The increased wear caused by braking during operation may destroy the holding brake prematurely!
- **Automatic DC braking must be deactivated if a holding brake is used.**

10.6.3.1 Basic setting

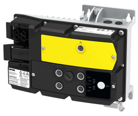
The following parameters must be set for the activation and basic configuration of the holding brake control.

When a power contactor is used, the response time and release time of the contactor are added to the brake application and release time. Both times must also be taken into consideration for parameterising the brake application time and brake opening time!

Deactivate automatic DC braking, if a holding brake is used.

Parameter

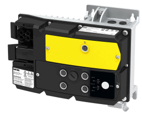
Address	Name / setting range / [default setting]		Information
0x2820:001	Holding brake control: Brake mode • Setting can only be changed if the inverter is disabled.		Selecting how the "Release holding brake" command is to be triggered.
	0	Automatically (via device state)	"Automatic operation": The "Release holding brake" command is automatically carried out as a function of the device state and further conditions. ⚠ CAUTION! In automatic operation, a manual release of the holding brake is also possible! For details see the following information for selection "Manually [1]".
	1	Manually	The "Release holding brake" command can also be initiated by the following external triggers: • Via the trigger assigned to the "Release holding brake" function in 0x2631:049 if the network control is not active. • Via bit 14 in the CiA control word 0x6040 if the network control is active. ⚠ CAUTION! • The manually triggered "Release holding brake" command has a direct impact on the "Release holding brake [115]" trigger. Thus, the holding brake can be manually released if the power section is switched off! • The ramp function generator only starts up when the brake is released in the case of manual control. • The responsibility for a manual release of the holding brake has the external trigger source for the "Release holding brake" command!
	2	**Off**	The holding brake is deactivated.
0x2820:002	Holding brake control: Brake closing time 0 ... [**100**] ... 10000 ms		Application time (engagement time) of the holding brake. • Only effective in automatic operation.



Address	Name / setting range / [default setting]		Information
0x2820:003	Holding brake control: Brake opening time 0 ... [**100**] ... 10000 ms		Release time (disengagement time) of the holding brake. • Only effective in automatic operation.
0x2820:015	Holding brake control: Brake status • Read only		Display of the holding brake status. • The status is also displayed via bit 14 in the CiA status word 0x6041.
	0	Brake closed	Holding brake is applied.
	1	Brake released	Holding brake is released.
0x2820:023	Holding brake control: Configuration output signal		Selection of which output signal is to be used to control the holding brake.
	0	**External digital output**	The holding brake is controlled via the internal brake module (outputs X105/BD1+BD2 or X106/BD1+BD2). • An open-circuit detection is active. • A parameterized voltage reduction is active.
	2	Internal brake voltage	The holding brake is controlled via the trigger "Release holding brake [115]". • This trigger must be assigned to a digital output. The digital output in turn controls a relay or power contactor which switches the brake supply. • The digital output is not suitable for direct control of a holding brake! • If, instead of an electrically releasing (self-holding) holding brake, an electrically holding (self-releasing) holding brake is to be controlled, a signal inversion must be set for the digital output used! ▸ Configure digital outputs 📖 194
0x2820:024	Holding brake control: Rated voltage • Setting can only be changed if the inverter is disabled.		Rated voltage of the holding brake. • The rated voltage is indicated on the nameplate of the holding brake. • For Lenze geared motors, the default setting must be used.
	2	104 VDC	
	4	**180 VDC**	
	6	205 VDC	
	7	215 VDC	

For examples and details on more possible settings, see the following subchapter:

- "Automatic" brake mode (automatic operation) 📖 154
- Brake holding load 📖 155
- Brake closing threshold 📖 157
- Manual release of the holding brake 📖 159



10.6.3.2 "Automatic" brake mode (automatic operation)

In automatic operation, the inverter automatically released the holding brake when the motor is started. In the stopped state, the holding brake is closed.

⚠ DANGER!

Manual release of the holding brake

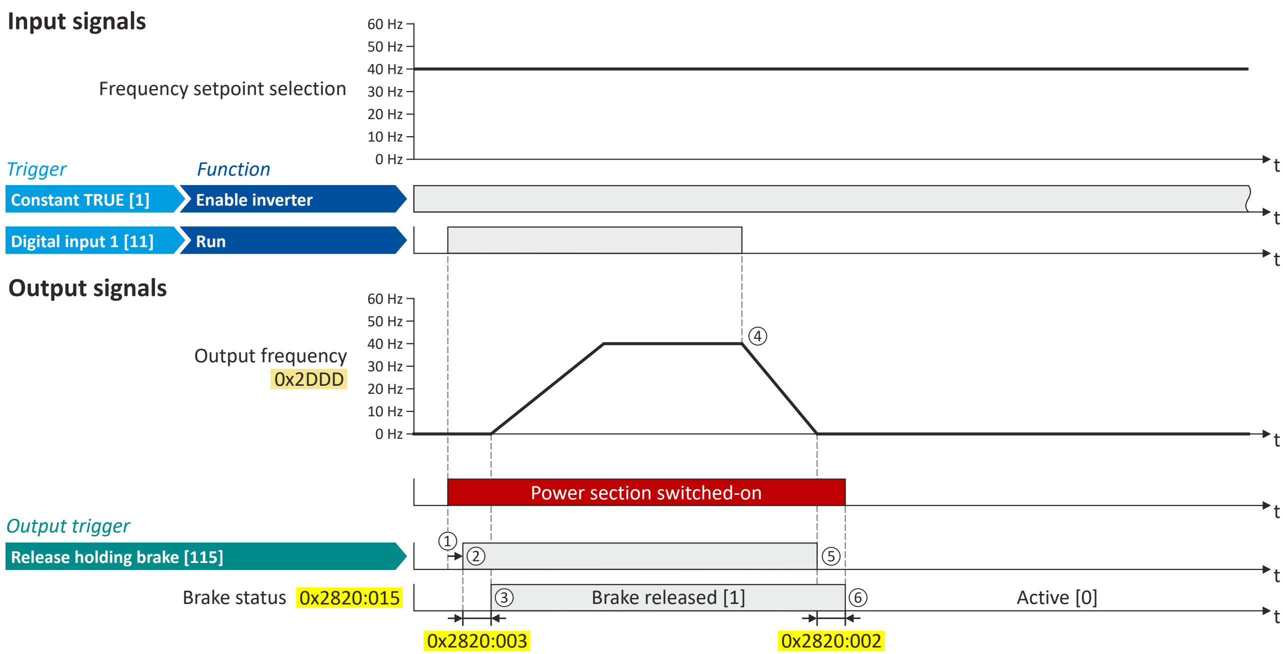
In automatic operation, a manual release of the holding brake is also possible. The manually triggered "Release holding brake" command has a direct impact on the "Release holding brake [115]" trigger. Thus, the holding brake can be manually released if the power section is switched off.

Possible consequences: Death, severe injuries or damage to property

- The responsibility for a manual release of the holding brake has the external trigger source for the "Release holding brake" command!

General mode of operation

The following diagram demonstrates the general functioning of the automatic operation:



① If the inverter is enabled and no error is active, the motor can be started with the "Run" function in forward rotating direction. The power section is switched on and the motor is magnetized first.

② The holding brake is released. In this case, the output trigger "Release holding brake [115]" is set to TRUE. This trigger must be assigned to a digital output or, in the simplest case, to the relay which then switches the brake supply.

③ After the release time 0x2820:003 has elapsed, the motor is accelerated to the setpoint. In 0x2820:015, the brake status "Brake released [1]" is displayed.

④ If "Run" is set to FALSE, the motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp.

⑤ Then the holding brake is closed again.

⑥ After the closing time 0x2820:002 has elapsed, the brake status "Brake closed [0]" is displayed in 0x2820:015.

ℹ If the power section is disabled, the holding brake is closed. Reasons for this can be an error, a fault, or the activation of the "Safe torque off (STO)" safety function.

10.6.3.3 Brake holding load

Depending on the application, a torque at the motor may be required at speed "0" of the motor shaft:

- In order to hold loads in vertical applications and prevent "sagging".
- In order to prevent a position loss in horizontal applications.

For this purpose, a brake holding load can be set. The brake holding load can be optionally generated via a ramp to reduce a vibration stimulation that may be caused by the brake holding load.

Preconditions

Ensure that the inverter builds up a sufficient torque in the motor when releasing and applying the holding, in order to hold the load.

- For this purpose, a V/f voltage boost can be set for the V/f characteristic control. ▶ Set voltage boost 📖 126
- The parameters for the V/f voltage boost are automatically set when you carry out an automatic identification of the motor.

Details

Relevant parameters:

- 0x2820:008: Brake holding load
- 0x2820:013: Holding load ramptime

Setting notes:

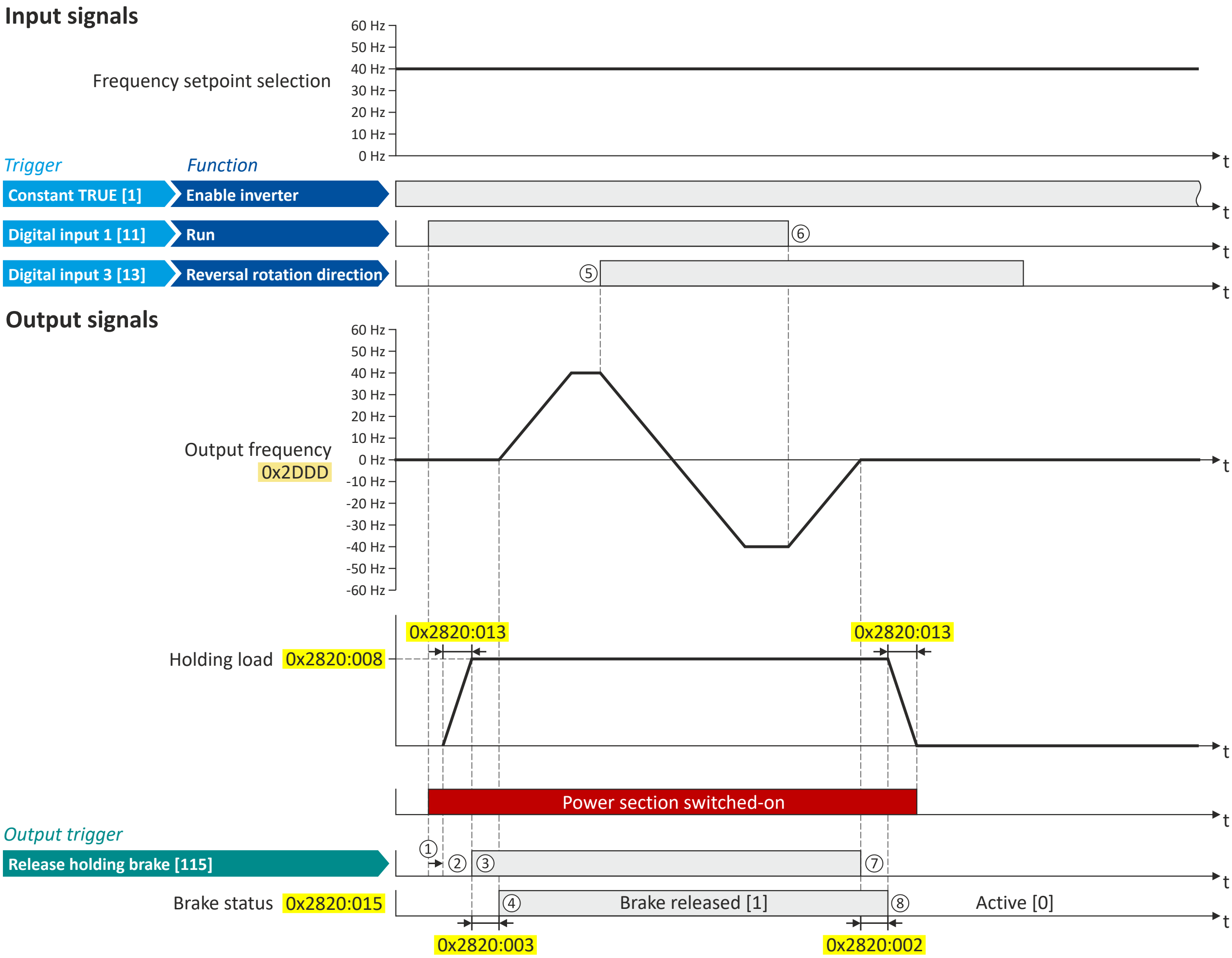
- In case of applications with constant load, a constant value is suitable for the brake holding load.
- If the load changes, an approximate value for the brake holding load has to be considered.
- Start with the setting "0 %" if you do not know the correct direction, otherwise with, for instance, "30 %". Afterwards change the setting upwards or downwards in 10-% steps.

Parameter

Address	Name / setting range / [default setting]	Information
0x2820:008	Holding brake control: Brake holding load -500.0 ... [**0.0**] ... 500.0 % • Setting can only be changed if the inverter is disabled.	By setting a holding load, the load can be held against the force of gravity in case of vertical applications, and a position loss can be prevented in case of horizontal applications. • The setting of "100 %" approximately corresponds to rated motor torque and slip frequency. Note! The torque for creating the holding load depends on the selected motor control type and its settings. Before using this function, make sure that you have set the motor control type correctly.
0x2820:013	Holding brake control: Holding load ramptime 0 ... [**0**] ... 100 ms • Setting can only be changed if the inverter is disabled.	By setting a ramp time, a vibration stimulation can be reduced that might be caused by the brake holding load 0x2820:008.

General mode of operation

The following diagram demonstrates the general functioning in automatic operation:



① If the inverter is enabled and no error is active, the motor can be started with the "Run" function in forward rotating direction. The power section is switched on and the motor is magnetized first.

② The brake holding load set in 0x2820:008 is build up via the ramp set in 0x2820:013.

③ The holding brake is released. In this case, the output trigger "Release holding brake [115]" is set to TRUE. This trigger must be assigned to a digital output or, in the simplest case, to the relay which then switches the brake supply.

④ After the release time 0x2820:003 has elapsed, the motor is accelerated to the setpoint. In 0x2820:015, the brake status "Brake released [1]" is displayed.

⑤ In case the direction of rotation reverses, the holding brake remains released.

⑥ If "Run" is set to FALSE, the motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp.

⑦ Then the holding brake is closed again.

⑧ After the closing time 0x2820:002 has elapsed, the brake status "Brake closed [0]" is displayed in 0x2820:015. The brake holding load is reduced again via the ramp.

10.6.3.4 Brake closing threshold

In some cases, a low speed does not make any sense from the application point of view. This includes applications with unfavorable load features, such as static friction. In such applications and depending on the type of control, a low speed may cause an unwanted behaviour. In order to prevent such an operating situation, a closing threshold can be set. The power section will only be switched on and the holding brake is opened if the setpoint is higher than the closing threshold. In order to prevent the holding brake from being closed if the setpoint only shortly falls below the closing threshold during operation, a delay time can be set in addition.

Preconditions

If the holding brake is controlled manually via an external control signal: It must be ensured that the motor does not move while the motor control is deactivated by this function.

Details

The function is part of the holding brake control and does not have independent functionality.

Relevant parameters:
- 0x2820:007: Brake closing threshold
- 0x2820:012: Closing threshold delay

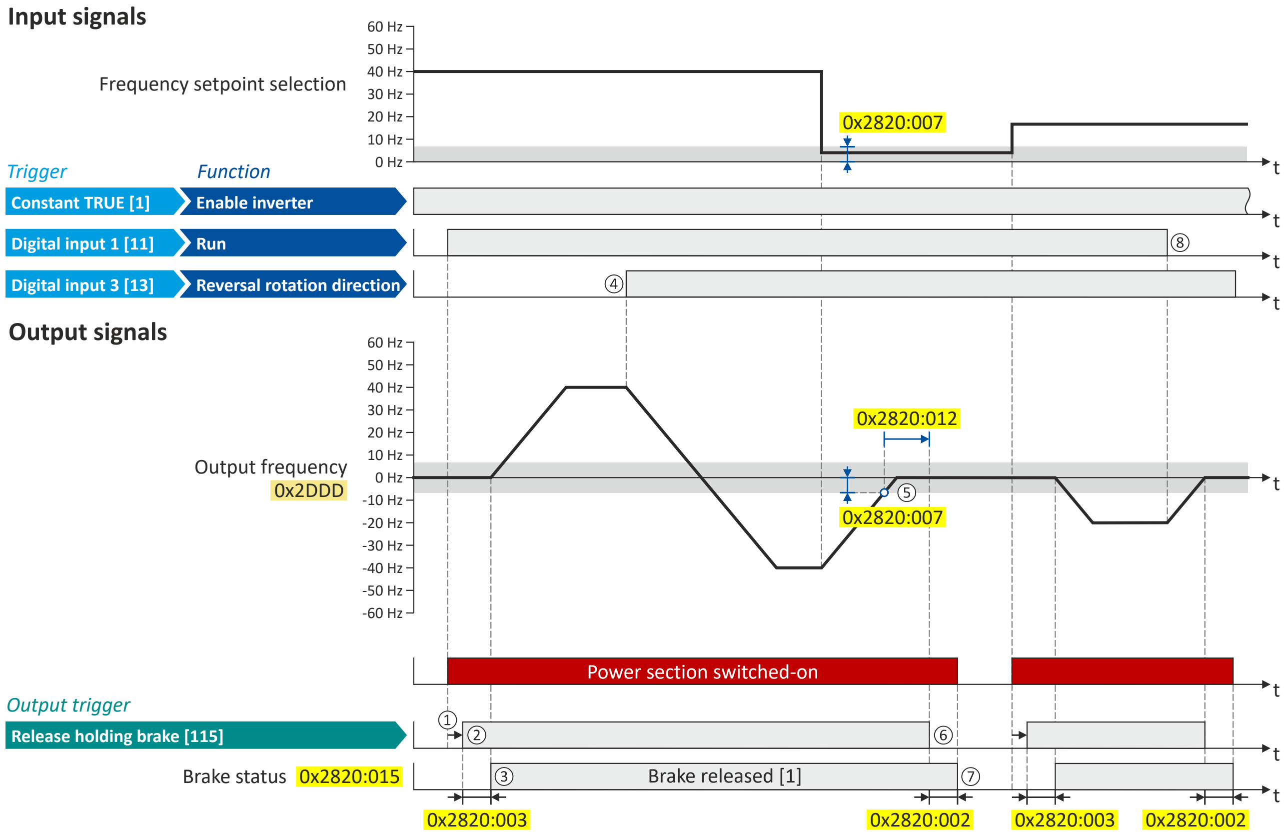
Setting notes:
- The function is active if the brake closing threshold is higher than 0 Hz.
- In order that the brake can work correctly, the brake closing threshold must be set to a value that is greater than or equals the minimum frequency 0x2915.
- The brake closing threshold has a permanent hysteresis of 1 Hz in order to prevent an unwanted change-over. Exception: If the brake closing threshold is set to 0 Hz, the hysteresis is also 0 Hz.
- If the brake closing threshold is set to 0 Hz, a start command is only required to release the holding brake during automatic operation.
- This function can be combined with the setting of a holding load.

Parameter

Address	Name / setting range / [default setting]	Information
0x2820:007	Holding brake control: Brake closing threshold 0.0 ... [**0.2**] ... 599.0 Hz	Threshold for closing the holding brake. • The power section will only be switched on and the holding brake will be opened if the setpoint is higher than the threshold set here. • In order that the brake can work correctly, the brake closing threshold must be set to a value that is greater than or equals the minimum frequency 0x2915. • The brake closing threshold has a permanent hysteresis of 1 Hz in order to prevent an unwanted change-over. Exception: If the brake closing threshold is set to 0 Hz, the hysteresis is also 0 Hz. • In case of a setting of "0 Hz", only a start command is required to release the holding break during automatic operation.
0x2820:012	Holding brake control: Closing threshold delay 0 ... [**0**] ... 10000 ms	By setting a deceleration, a closing of the holding brake can be prevented if the frequency only temporarily falls below the brake closing threshold 0x2820:007.

General mode of operation

The following diagram demonstrates the general functioning in automatic operation:



① If the inverter is enabled and no error is active, the motor can be started with the "Run" function in forward rotating direction. The power section is switched on and the motor is magnetized first.

② The holding brake is released. In this case, the output trigger "Release holding brake [115]" is set to TRUE. This trigger must be assigned to a digital output or, in the simplest case, to the relay which then switches the brake supply.

③ After the release time 0x2820:003 has elapsed, the motor is accelerated to the setpoint. In 0x2820:015, the brake status "Brake released [1]" is displayed.

④ If the direction of rotation reverses, the holding brake remains released (even if the closing threshold delay is running.)

⑤ If the setpoint selection and the internal setpoint for the motor control fall below the brake closing threshold set in 0x2820:007, the output frequency is ramped down to "0 Hz". At the same time the closing threshold delay set in 0x2820:012 starts to run.

⑥ If the values fall below the closing threshold longer than the closing threshold delay, the holding brake is closed again.

⑦ After the closing time 0x2820:002 has elapsed, the brake status "Brake closed [0]" is displayed in 0x2820:015.

⑧ If "Run" is set to FALSE, the motor is stopped with the stop method set in 0x2838:003. In the example: Stop with standard ramp. In this case, closing threshold and closing threshold delay are not effective anymore.

10.6.3.5 Manual release of the holding brake

The "Open holding brake" function serves to release the holding brake immediately. Brake application time and brake opening time as well as the conditions for the automatic operation are not effective.

Preconditions

- Observe setting and application notes in the "Holding brake control" chapter! 📖 152
- The brake mode "Automatic [0]" or "Manual [1]" must be set in 0x2820:001.
- The trigger "Release holding brake [115]" must be assigned to a digital output or, in the simplest case, to the relay which then switches the brake supply.

Details

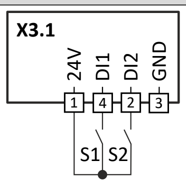
A manual opening of the holding brake is possible in the modes "Automatic [0]" and "Manual [1]" via the following external triggers:
- Via bit 14 in the CiA control word 0x6040.
- Via the trigger in 0x2631:049 assigned to the "Open holding brake" function. ▸ Example for operating mode 📖 159

Parameter

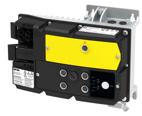
Address	Name / setting range / [default setting]		Information
0x2631:049	Function list: Open holding brake • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Open holding brake" function. Trigger = TRUE: open holding brake (immediately). Trigger = FALSE: no action. Notes: • Function is only executed if the brake mode 0x2820:001 is set to "Automatic [0]" or "Manual [1]". ⚠ CAUTION! • The manually triggered "Open holding brake" command has a direct impact on the "Release holding brake [115]" trigger. Thus, the holding brake can be manually released if the power section is switched off! • The responsibility for a manual opening of the holding brake lies with the external trigger source for the "Open holding brake" command!
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).

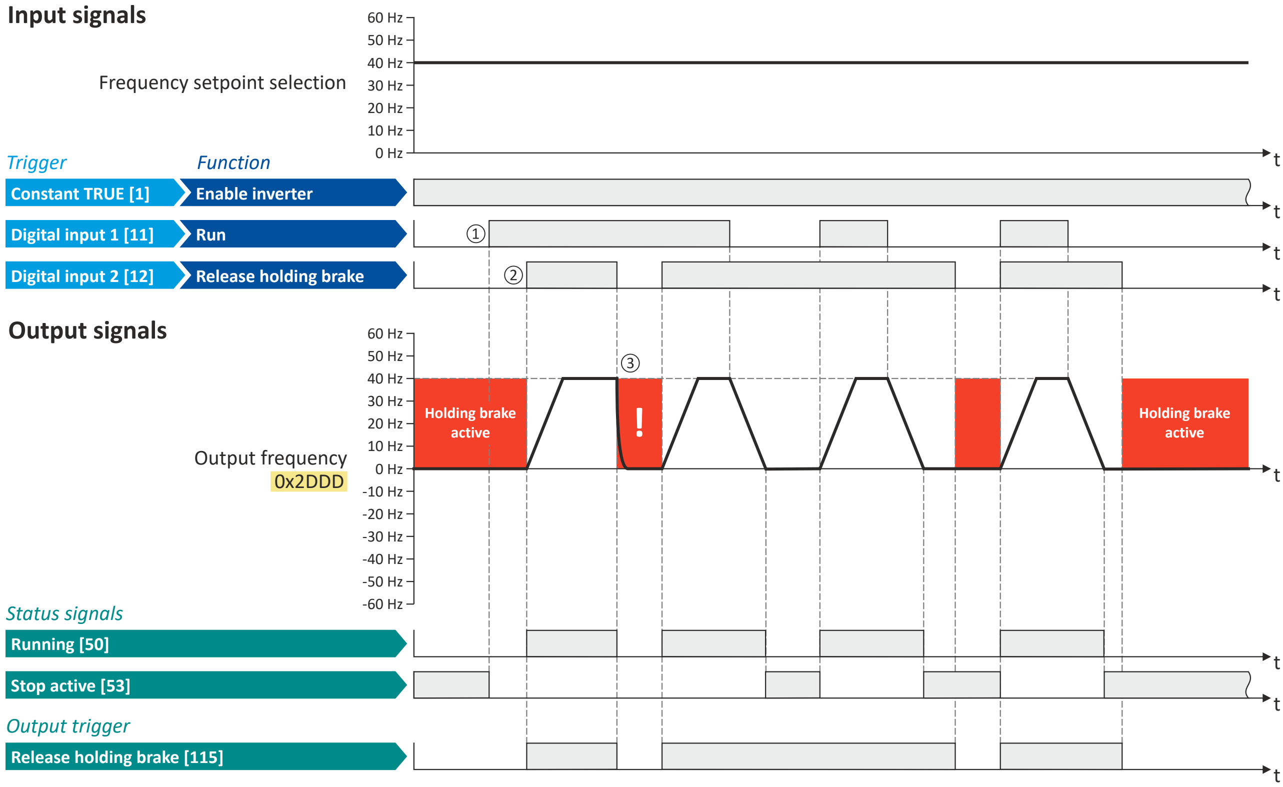
Example for operating mode

- Switch S1 starts the motor in forward direction of rotation. Switch S1 in initial position stops the motor again.
- Switch S2 opens the holding brake. For this purpose, in this example, trigger "Release holding brake [115]" is assigned to the relay that switches the brake supply.

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Open holding brake

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:049	Open holding brake	Digital input 2 [12]
0x2838:003	Stop method	Standard ramp [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz





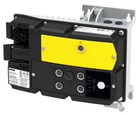
The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① As the holding brake is active, the motor does not yet start to rotate after the start command.
② The holding brake is opened. The motor is led to the setpoint.
③ **Note:** Holding brakes are not intended for braking during operation. The increased wear caused by braking during operation may destroy the holding brakes prematurely!

10.6.4 Load loss detection

Parameter

Address	Name / setting range / [default setting]		Information
0x4006:001	Load loss detection: Threshold 0.0 ... [**0.0**] ... 200.0 %		Threshold for load loss detection. • 100 % = rated motor current 0x6075
0x4006:002	Load loss detection: Delay time 0.0 ... [**0.0**] ... 300.0 s		Tripping delay for load loss detection.
0x4006:003	Load loss detection: Error response		Selection of the response following the detection of a load loss. Associated error code: • 65336 | 0xFF38 - Load loss detected
	0	**No response**	▶ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	



10.7 Options for optimizing the control loops

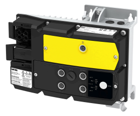
Various options are available for optimizing the control:

a) Select motor from motor catalog 📖 47
b) Automatic motor identification (energized) 📖 163
c) Automatic motor calibration (non-energized) 📖 164
d) Tuning of the motor and the speed controller 📖 165

Details

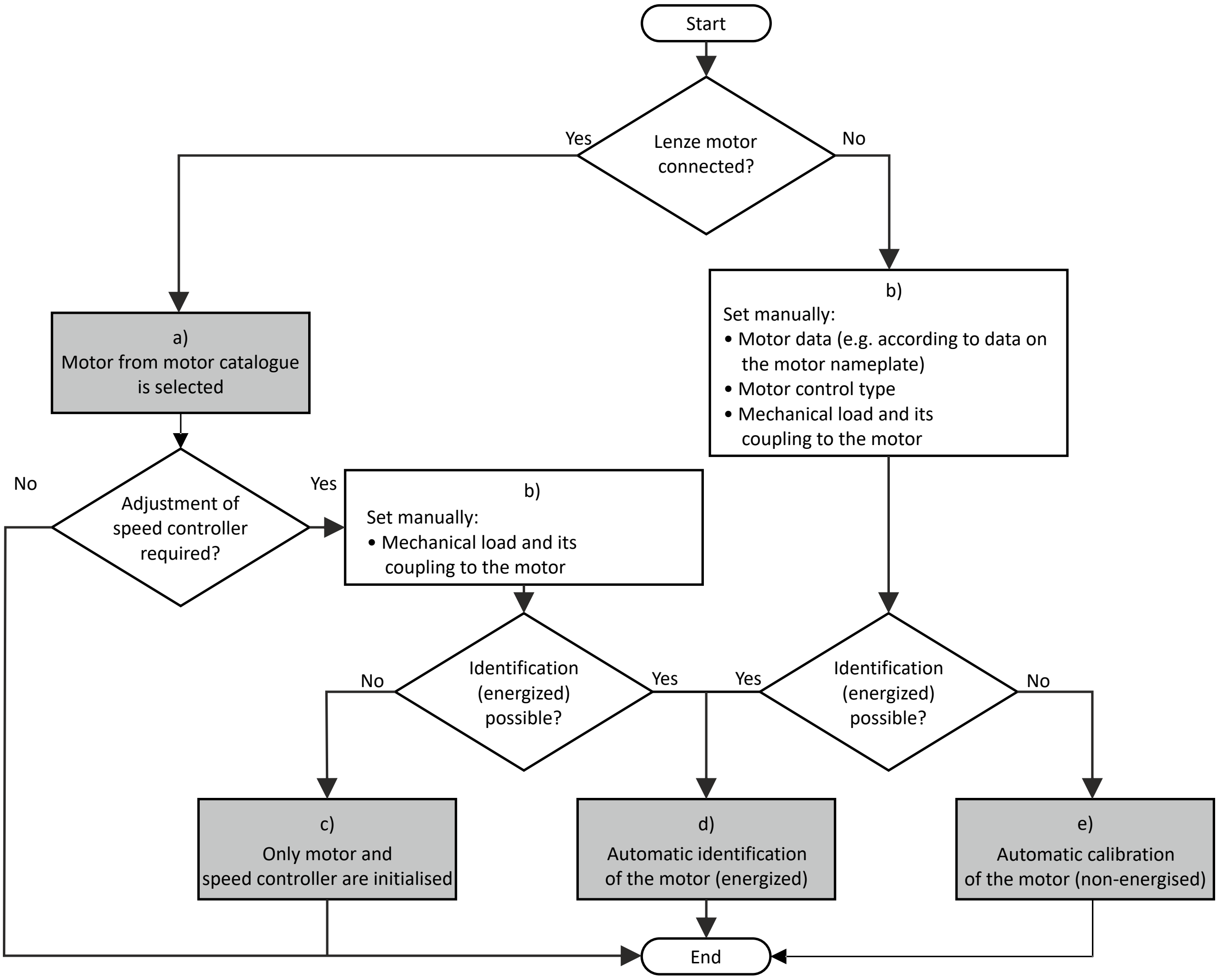
The option to be selected depends on the respective application. Depending on the selected option, different procedures become active and thus different parameter groups are influenced:

- Rated motor data
- Inverter characteristic
- Motor equivalent circuit diagram data
- Motor controller settings
- Speed controller settings



Performing optimization with engineering tool

The following flow diagram shows the optimization process with an engineering tool (e. g. »EASY Starter«):



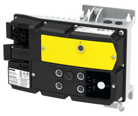
a) The relevant motor data must be set first. You benefit from very precise motor equivalent circuit diagram data by selecting the motor from the motor catalogue.
▸ Select motor from motor catalog 🕮 47

b) Manually set the motor data in accordance with the manufacturer's information / motor data sheet when a third-party motor is connected to the inverter.
▸ Manual setting of the motor data 🕮 48

c) The speed controller must be first reinitialised alone if the load adjustment in the optimized system has changed.
▸ Tuning of the motor and the speed controller 🕮 165

d) If the application enables you to energise the system during the optimization procedure, carry out an automatic identification. This procedure results in the best possible parameter settings.
▸ Automatic motor identification (energized) 🕮 163

e) If the application does **not** enable you to energise the system during the optimization procedure, carry out an automatic calibration.
▸ Automatic motor calibration (non-energized) 🕮 164



10.7.1 Automatic motor identification (energized)

The automatic identification of the motor results in the best possible parameter settings. If the application enables you to energise the system during the optimization, carry out this optimization.

Conditions

The motor must be cold and at a standstill.

- All rated motor data are known and set in the inverter, either by selecting the motor from the motor catalog or manually:
  - Select motor from motor catalog 47
  - Manual setting of the motor data 48
- In 0x2C00, the motor control type required is suitable for the motor selected.
- In 0x6060, the operating mode "MS: Velocity mode [-2]" or "CiA: Velocity mode (vl) [2]" is set.
- DC-bus voltage is available.
- The inverter is error-free and in the "Ready to switch on" or "Switched on" device state.
- The motor is stopped (no start enable).
- No inverter disable is active.
- No quick stop is active.
- No other axis command is active.

General information on the identification

- The automatic identification can take from some seconds to minutes.
- The procedure can be aborted any time by inverter disable or cancellation of the start enable without settings being changed.
- During calibration and after the calibration has been completed successfully, the blue LED display is constantly on. As soon as the identification has been executed and the device is deactivated, the LED changes to a blinking mode.
- After completion, a renewed start command is required to start the motor.

Required steps

Optimization with engineering tool (e. g. »EASY Starter«):

1. Go to the "Settings" tab and navigate to the parameterization dialog "Advanced motor setting".
2. Press the **Energized** button under "motor calibration".
3. Follow the instructions of the engineering tool.

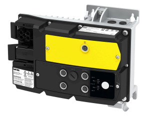
Parameter

Address	Name / setting range / [default setting]	Information
0x2822:004	Axis commands: Identify motor data (energized) 0 ... **[0]** ... 1	1 = start automatic identification of the motor data. • Inverter characteristics, motor equivalent circuit diagram data and controller settings are identified and set automatically. • During the procedure, the motor is energised!

Optimization process

As soon as the process has been started, the following steps are initiated:

1. The inverter characteristic is automatically identified by the inverter.
2. The motor equivalent circuit diagram data are automatically identified by the inverter.
3. The motor controller settings are automatically calculated.
4. The speed controller settings are automatically calculated.



10.7.2 Automatic motor calibration (non-energized)

If the application does not enable you to energise the system during the optimization, carry out this optimization.

Preconditions

- All rated motor data is known and set in the inverter, either by selecting the motor from the motor catalogue or manually.
  ▸ Select motor from motor catalog 📖 47
  ▸ Manual setting of the motor data 📖 48
- In 0x2C00, the motor control type required and suitable for the motor is selected.
- The inverter is error-free and in the "Ready to switch on" or "Switched on" device state.
- The inverter is disabled or the motor is stopped (no start enable).
- No other axis command is active anymore.

Required steps

Optimization with engineering tool (e. g. »EASY Starter«):

1. Go to the "Settings" tab and navigate to the parameterisation dialog "Advanced motor setting".
2. Click the **Non-energized** button under "motor calibration".
3. Follow the instructions of the engineering tool.

Parameter

Address	Name / setting range / [default setting]	Information
0x2822:005	Axis commands: Calibrate motor data (non-energized) 0 ... **[0]** ... 1	1 = start automatic calibration of the motor data. • A default inverter characteristic is loaded. • the motor equivalent circuit diagram data and controller settings are calculated on the basis of the currently set rated motor data. • The motor is not energised.

Optimization process

As soon as the process has been started, the following steps are initiated:

1. A default inverter characteristic is loaded.
2. The motor equivalent circuit diagram data is calculated based on the currently set rated motor data.
3. The motor controller settings are automatically calculated.
4. The speed controller settings are automatically calculated.

10.7.3 Tuning of the motor and the speed controller

The following describes in general how to optimize the speed controller. This may be required if some parameters on the load side of the drive system have changed or have not been set yet, such as:

- Motor moment of inertia
- Load moment of inertia
- Type of coupling between motor moment of inertia and load moment of inertia

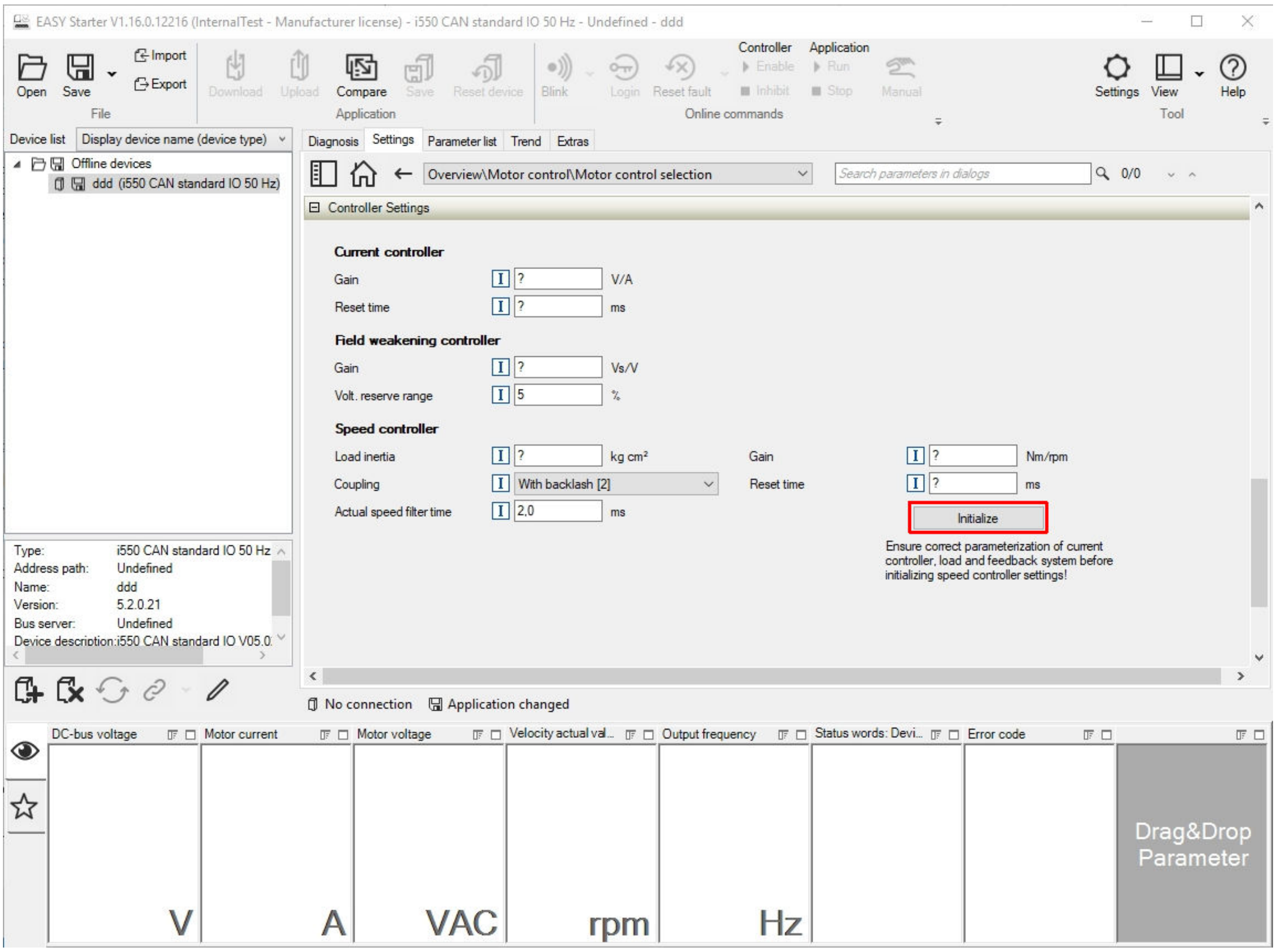
Preconditions

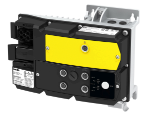
- All rated motor data is known and set in the inverter, either by selecting the motor from the motor catalog or manually.
  ▶ Select motor from motor catalog 📖 47
  ▶ Manual setting of the motor data 📖 48
- All further options for optimization have been executed before if possible.
  ▶ Automatic motor identification (energized) 📖 163
  ▶ Automatic motor calibration (non-energized) 📖 164
- Optimization is possible online or offline (with or without connected motor).

Required steps

Adapt the following parameters to your drive system using the engineering tool. Since this only changes load-dependent data, the other parameter groups do not need to be calculated again.

In the engineering tool, the speed control settings can be confirmed via the **Initialise** button.





Parameter

Address	Name / setting range / [default setting]		Information
0x2910:001	Inertia settings: Motor moment of inertia 0.00 ... [**3.70**] ... 20000000.00 kg cm²		Setting of the moment of inertia of the motor, relating to the motor.
0x2910:002	Inertia settings: Scaled load inertia 0.00 ... [**0.00**] ... 20000000.00 kg cm²		Setting of the moment of inertia of the load. • Always adjust the setting to the current load, otherwise the optimisation process for the speed controller cannot be executed successfully.
0x2910:003	Inertia settings: Coupling		Selection of the type of coupling between the moment of inertia of the motor and that of the load.
	0	Stiff	
	1	Elastic	
	2	**With backlash**	

For further details on the speed controller, see chapter "Speed controller". 169

10.7.4 Inverter characteristic

The inverter characteristic is automatically set if one of the following optimizations is carried out:

- Automatic motor identification (energized) 163
- Automatic motor calibration (non-energized) 164

The settings made can be seen if required, but should not be changed. A wrong setting may influence the control negatively!

Parameter

Address	Name / setting range / [default setting]	Information
0x2947:001 ... 0x2947:017	Inverter characteristic: Value y1 ... Value y17 0.00 ... [**0.00**] ... 20.00 V	The inverter characteristic (consisting of 17 values) is calculated and set during the automatic identification of the motor data. If only an automatic calibration of the motor data is carried out, a default inverter characteristic is loaded instead. Note! Changing these values is not recommended by the manufacturer.

10.7.5 Motor equivalent circuit diagram data

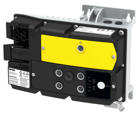
The motor equivalent circuit diagram data are automatically set if one of the following optimizations is carried out:

- Select motor from motor catalog 47
- Automatic motor identification (energized) 163
- Automatic motor calibration (non-energized) 164

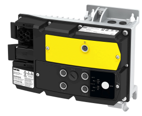
If you use a motor of a different manufacturer, you must adapt the data, e. g. from the motor data sheet according to the sizes and units mentioned if required.

Parameter

Address	Name / setting range / [default setting]	Information
0x2C01:002	Motor parameters: Stator resistance 0.0000 ... [**13.5000**] ... 125.0000 Ω	General motor data. Carry out settings as specified by manufacturer data/motor data sheet. Note! When you enter the motor nameplate data, take into account the phase connection implemented for the motor (star or delta connection). Only enter the data applying to the connection type selected.
0x2C01:003	Motor parameters: Stator leakage inductance 0.000 ... [**51.000**] ... 500.000 mH	



Address	Name / setting range / [default setting]	Information
0x2C02:001	Motor parameter (ASM): Rotor resistance 0.0000 ... [**8.8944**] ... 200.0000 Ω	Equivalent circuit data required for the motor model of the asynchronous machine.
0x2C02:002	Motor parameter (ASM): Mutual inductance 0.0 ... [**381.9**] ... 50000.0 mH	
0x2C02:003	Motor parameter (ASM): Magnetising current 0.00 ... [**0.96**] ... 500.00 A	
0x2C03:001	Motor parameter (PSM): Back EMF constant 0.0 ... [**41.8**] ... 100000.0 V/1000rpm	Voltage induced by the motor (rotor voltage / 1000 rpm). For permanently excited synchronous motors, the e.m.f. constant describes the r.m.s. value of the line-to-line voltage (phase voltage) induced in idle state by the motor (reference: 1000 rpm, 20 °C). Measured: Line to Line (L - L)
0x2C03:005	Motor parameter (PSM): D-axis inductance Ld 0.000 ... [**23.566**] ... 500.000 mH	Presetting the inductance of the D-axis Ld.
0x2C03:006	Motor parameter (PSM): Q-axis inductance Lq 0.000 ... [**23.566**] ... 500.000 mH	Presetting the inductance of the Q-axis Lq.



10.7.6 Motor control settings

After the motor settings have been made, the different control loops must be set. For a quick commissioning, the calculations and settings are made automatically if one of the following optimizations is carried out:

- Select motor from motor catalog 47
- Automatic motor identification (energized) 163
- Automatic motor calibration (non-energized) 164

Details

The following controllers have an influence in the respective motor control type:

Controller	Motor control type				
	VFC open loop	**VFC closed loop**	**SC-ASM**	**SLSM-PSM**	**SLVC**
Speed controller 169			●	●	●
Current controller 170	●	●	●		●
Current controller (field-oriented control) 170				●	
ASM field controller 171			●		●
ASM field weakening controller 171			●		●
PSM operation outside the voltage range 172				●	
Imax controller 172	●	●			
Flying restart controller 173	●				●
SLVC controller 173					●
Slip controller 174		●			

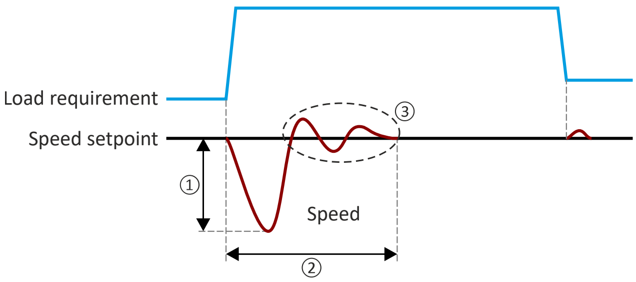
VFC open loop = V/f characteristic control
VFC closed loop = V/f characteristic control with speed feedback
SC-ASM = servo control for asynchronous motor
SLSM-PSM = sensorless control for synchronous motor
SLVC = sensorless vector control

10.7.6.1 Speed controller

For a quick commissioning, the calculations and settings are made automatically during the optimization.

For typical applications, a manual adaptation of the parameters of the speed controller is not recommended. A wrong setting may have a negative effect on the control. For special applications, contact the manufacturer before adapting the parameters.

The automatically calculated settings for the speed controller enable an optimal control behaviour for typical load requirements. The oscillographed actual speed value (red) shows the control mode.



1	Minimum speed loss	3	Minimum overshoot
2	Minimum settling time		

Setting notes

If oscillations occur during operation after high loads:

- Reduce gain of the speed controller in 0x2900:001.
- Increase reset time of the speed controller in 0x2900:002.

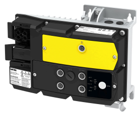
If the speed loss is too high or the settling time too long during operation with high loads:

- Increase gain of the speed controller in 0x2900:001.

If the gain is set too high or the reset time too low, the speed control loop can become unstable!

Parameter

Address	Name / setting range / [default setting]	Information
0x2900:001	Speed controller settings: Gain 0.00000 ... [**0.00033**] ... 20000.00000 Nm/rpm	Gain factor Vp of the speed controller.
0x2900:002	Speed controller settings: Reset time 1.0 ... [**17.6**] ... 6000.0 ms	Reset time Ti of the speed controller.
0x2904	Actual speed filter time 0.0 ... [**2.0**] ... 50.0 ms	Time constant for the actual speed value filter.



10.7.6.2 Current controller

For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

For typical applications, a manual adaptation of the parameters of the current controller is not recommended. A wrong setting may have a negative effect on the control. For special applications, contact the manufacturer before adapting the parameters.

Preconditions

The current controller parameters are calculated based on the stator resistance and leakage inductance. Thus, the following parameters must be set correctly, either via optimization or manually (according to manufacturer-data/motor data sheet):

- 0x2C01:002: Stator resistance
- 0x2C01:003: Stator leakage inductance

▶ Motor equivalent circuit diagram data 📖 166

Parameter

Address	Name / setting range / [default setting]	Information
0x2942:001	Current controller parameters: Gain 0.00 ... [**148.21**] ... 750.00 V/A	Gain factor Vp of the current controller.
0x2942:002	Current controller parameters: Reset time 0.01 ... [**3.77**] ... 2000.00 ms	Reset time T_n of the current controller.

10.7.6.3 Current controller (field-oriented control)

For quick commissioning, the calculations and settings are made automatically during the motor calibration.

For typical applications, a manual adaptation of the parameters of the current controller is not recommended. An incorrect setting may have a negative effect on the control. For special applications, contact the manufacturer before adapting the parameters.

Preconditions

The current controller described here is only effective in the following motor control mode:

- Sensorless control for synchronous motors (SLSM-PSM)

The current controller parameters are calculated based on the stator resistance and leakage inductance. Thus, the following parameters must be set correctly, either via optimization or manually (according to manufacturer-data/motor data sheet):

- 0x2C01:002: Stator resistance
- 0x2C03:005: D-axis inductance Ld
- 0x2C03:006: Q-axis inductance Lq

▶ Motor equivalent circuit diagram data 📖 166

Parameter

Address	Name / setting range / [default setting]	Information
0x2942:004	Current controller parameters: d-axis gain 0.00 ... [**148.21**] ... 750.00 V/A	Current controller parameters for "SLSM-PSM" motor control mode. ▶ Sensorless control for synchronous motor (SLSM-PSM) 📖 139
0x2942:005	Current controller parameters: d-axis reset time 0.01 ... [**3.77**] ... 2000.00 ms	
0x2942:006	Current controller parameters: q-axis gain 0.00 ... [**148.21**] ... 750.00 V/A	
0x2942:007	Current controller parameters: q-axis reset time 0.01 ... [**3.77**] ... 2000.00 ms	

10.7.6.4 ASM field controller

For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

Preconditions

The field controller is only effective in the following motor control types:

- Servo control (SC ASM)
- Sensorless vector control (SLVC)

Parameter

Address	Name / setting range / [default setting]	Information
0x29C0:001	Field controller settings: Gain 0.00 ... [**165.84**] ... 50000.00 A/Vs	Gain factor Vp of the field controller.
0x29C0:002	Field controller settings: Reset time 1.0 ... [**15.1**] ... 6000.0 ms	Reset time Tn of the field controller.

10.7.6.5 ASM field weakening controller

For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

Preconditions

The field weakening controller is only effective in the following motor control types:

- Servo control (SC ASM)
- Sensorless vector control (SLVC)

Parameter

Address	Name / setting range / [default setting]	Information
0x29E0:001	Field weakening controller settings: Gain (ASM) 0.000 ... [**0.000**] ... 2000000.000 Vs/V	Gain factor Vp of the field weakening controller.
0x29E0:002	Field weakening controller settings: Reset time (ASM) 1.0 ... [**2000.0**] ... 240000.0 ms	Reset time Tn of the field weakening controller.
0x29E1	Field weakening controller Field limitation 5.00 ... [**100.00**] ... 100.00 %	Field limitation of the field weakening controller.

10.7.6.6 ASM field weakening controller (extended)

For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

Preconditions

The field weakening controller is only effective in the following motor control types:

- Servo control (SC ASM)
- Sensorless vector control (SLVC)

Parameter

Address	Name / setting range / [default setting]	Information
0x29E2	DC-bus filter time 1.0 ... [**25.0**] ... 1000.0 ms	Filter time for the current DC-bus voltage used for field weakening.
0x29E3	Motor voltage filter time 1.0 ... [**25.0**] ... 1000.0 ms	Filter time for the current motor voltage used for field weakening.
0x29E4	Voltage reserve range 0 ... [**5**] ... 20 %	Voltage reserve at the transition point to the field weakening, with reference to the current value of the DC-bus voltage. Effective with Servo control (SC ASM) (0x2C00 = 2), Sensorless control (SL PSM) (0x2C00 = 3) and with Sensorless vector control (SLVC) (0x2C00 = 4). • 100% = DC-bus voltage 0x2D87

10.7.6.7 PSM operation outside the voltage range

Parameter

Address	Name / setting range / [default setting]	Information
0x29E0:003	Field weakening controller settings: Reset time (PSM) 1.0 ... [**40.0**] ... 240000.0 ms	In the time configured (default 800 ms), the swivel control rotates the current phasor by 90°. Increasing the time makes the system smoother at the voltage limit. At the same time, it also reduces the dynamics.

10.7.6.8 Imax controller

For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

For typical applications, a manual adaptation of the parameters of the Imax controller is not recommended. A wrong setting may have a negative effect on the control. For special applications, contact the manufacturer before adapting the parameters.

Preconditions

The Imax controller is only effective in the following motor control types:

- V/f characteristic control (VFC open loop)
- V/f characteristic control (VFC closed loop)

Details

The Imax controller becomes active in the V/f operation if the actual motor current exceeds the maximum current "Max. current". The Imax controller changes the output frequency to counteract the exceedance.

The maximum current "Max. current" is defined in 0x6073 in percent with regard to the rated motor current "Rated motor current" 0x6075.

If the maximum current is exceeded:

- During operation in motor mode, the Imax controller reduces the output frequency.
- During operation in generator mode, the Imax controller increases the output frequency.

Setting notes

If oscillations occur at the current limit during operation:

- Reduce gain of the Imax controller in 0x2B08:001.
- Increase reset time of the Imax controller in 0x2B08:002.
- Carry out the changes in small steps only (by 2 ... 3 % of the set value) until the oscillations do not exist anymore.

If the Imax controller does not respond fast enough after the maximum current has been exceeded:

- Increase gain of the Imax controller in 0x2B08:001.
- Reduce reset time of the Imax controller in 0x2B08:002.
- Carry out the changes in small steps only (by 2 ... 3 % of the set value in each case) until the response time is acceptable.

Parameter

Address	Name / setting range / [default setting]	Information
0x2B08:001	V/f Imax controller: Gain 0.000 ... [**0.284**] ... 1000.000 Hz/A	Gain factor Vp of the Imax controller.
0x2B08:002	V/f Imax controller: Reset time 1.0 ... [**2.3**] ... 2000.0 ms	Reset time Ti of the Imax controller.

10.7.6.9 Flying restart controller

For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

Preconditions

The flying restart controller is only effective in the following motor control types:

- V/f characteristic control (VFC open loop)
- Sensorless control (SL PSM)
- Sensorless vector control (SLVC)

Details

The following parameter is only relevant for the flying restart circuit if an asynchronous motor is controlled. In case of a sensorless control of a synchronous motor (SL-PSM) the parameter has no meaning.

Parameter

Address	Name / setting range / [default setting]	Information
0x2BA1:003	Flying restart circuit: Restart time 1 ... [**5911**] ... 60000 ms	Integration time for controlling the flying restart circuit.

10.7.6.10 SLVC controller

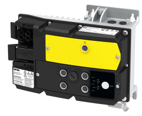
For a quick commissioning, the calculations and settings are made automatically during the motor calibration.

Preconditions

The SLVC controller is only effective in the motor control type "Sensorless vector control (SLVC)".

Parameter

Address	Name / setting range / [default setting]	Information
0x2B40:001	SLVC: Gain 0.0000 ... [**0.2686**] ... 1000.0000 Hz/A	Gain of the SLVC-Q controller.
0x2B40:002	SLVC: Reset time 1.0 ... [**2.3**] ... 2000.0 ms	Reset time of the SLVC-Q controller.



10.7.6.11 Slip controller

In case of V/f characteristic control with feedback (VFC closed loop), the slip is calculated and injected by the slip controller. The default setting of the slip controller provides robustness and moderate dynamics.

Preconditions

In 0x2C00, the motor control type "V/f characteristic control (VFC closed loop) [7]" is selected and configured. For details, see chapter "V/f characteristic control for asynchronous motor (VFC closed loop)". 📖 137

Details

- The slip controller is designed as a PI controller.
- In order to improve the response to setpoint changes, the setpoint speed or setpoint frequency is added as a feedforward control value to the output (correcting variable) of the slip controller.
- With the setting 0x2B14:003 = 0 Hz, the slip controller is deactivated.

Controller gain Vp

The gain setting range of the slip controller Vp 0x2B14:001, which causes a stable operating power, mainly depends on the resolution of the speed sensor. There is a direct relation between the encoder resolution and the gain:

- The higher the encoder resolution, the higher the gain can be set. The following table contains the required gains for the encoder with standard encoder increments:

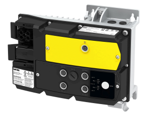
Encoder increment [increments / revolution]	recommended
8	0.06
64	0.31
100	0.47
120	0.57
128	0.6
256	0.77
386	0.98
512	1.18
640	1.38
768	1.59
896	1.79
1014	2
1536	2.81
2048	3.63
3072	5.26
4096	6.9

Parameter

Address	Name / setting range / [default setting]	Information
0x2B14:001	Slip controller: Gain 0.000 ... [**0.100**] ... 65.535	Gain of the slip controller.
0x2B14:002	Slip controller: Reset time 0.0 ... [**100.0**] ... 6553.5 ms	Reset time of the slip controller.
0x2B14:003	Slip controller: Frequency limitation 0.00 ... [**10.00**] ... 100.00 Hz	Frequency limitation of the slip controller. • With the setting of 0 Hz, the slip controller is deactivated.

10.8 Motor protection

Many monitoring functions integrated in the inverter can detect errors and thus protect the device or motor from being destroyed or overloaded.



10.8.1 Motor overload monitoring (i²xt)

This function monitors the thermal overload of the motor, taking the motor currents recorded and a mathematical model as a basis.

⚠ DANGER!

Fire hazard by overheating of the motor.

Possible consequences: Death or severe injuries

- To achieve full motor protection, an additional temperature monitoring function with a separate evaluation must be installed.
- When operating motors that are equipped with PTC thermistors or thermal contacts, always activate the PTC input. When used alone (without i2T monitoring), PTC thermistors or thermal contacts do not fulfil NEC conformity requirements according to article 430.

Details

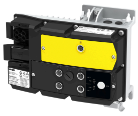
This function only serves to functionally protect the motor. It is not suitable for safety-relevant protection against energy-induced hazards, since the function is not fail-safe.

- When the thermal motor utilisation calculated reaches the threshold set in 0x2D4B:001, the response set in 0x2D4B:003 is triggered.
- With the setting 0x2D4B:003 = "No response [0]", the monitoring function is deactivated.

For NEC Article 430-compliant operation with motor overload protection, do not change default settings 0x2D4B:002 and 0x2D4B:003!
(0x2D4B:002 = "On [0], 0x2D4B:003 = "error [3]"). With these settings, the calculated thermal motor load is stored internally when the inverter is switched off and reloaded when it is switched back on. If monitoring is deactivated with setting 0x2D4B:003 = "No response [0]" or "Warning [1]", the motor overload protection is deactivated. For NEC Article 430-compliant operation in this mode, external overload protection must be provided by the end user.

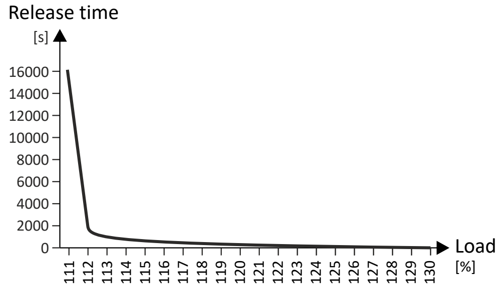
When monitoring the motor temperature with a suitable temperature sensor at terminals X109/T1 and X109/T2: if the motor temperature monitoring is set (0x2D4B:002 to "Error [3]"), the motor overload monitoring (0x2D4B:003) can also be set differently to "Error [3]".
If the monitoring has the setting (0x2D4B:003 = "No reaction [0]" or "Warning [1]"), the motor overload protection is deactivated. For NEC Article 430-compliant operation in this mode, external overload protection must be provided by the end user.

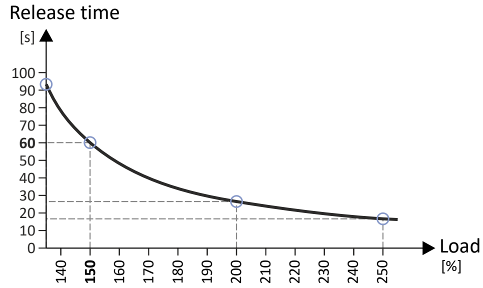
▸ Motor temperature monitoring 📖 180



The following two diagrams show the relation between the motor load and tripping time of the monitoring under the following conditions:

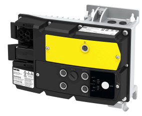
- Maximum utilization 0x2D4B:001 = 150 %
- Speed compensation 0x2D4B:002 = "Off [1]" or output frequency ≥ 40 Hz





Maximum utilization 60s [%] ▸ 0x2D4B:001	**Load ratio [%]**	**Tripping time [s]**
150	110	Indefinite
150	135	93
150	150	60
150	200	26
150	250	17

Calculation
Load ratio: Load ratio = actual motor current 0x2D88 / rated motor current 0x6075
Maximum load ratio for continuous operation at an output frequency ≥ 40 Hz: Maximum load ratio for continuous operation [%] = 0.73 * maximum utilization 0x2D4B:001
Release time at an output frequency ≥ 40 Hz and a load ratio > maximum load ratio for continuous operation: Tripping time [s] ≈ 15.9 / ((load ratio/maximum utilization 0x2D4B:001) – 0.724) [s]



Speed compensation for protecting motors at low speed

The inverter has implemented a compensation for low speeds. If the motor is operated with frequencies below 40 Hz, the speed compensation in 0x2D4B:002 must be set to "On [0]" (default). This setting ensures that the tripping time for the monitoring is reduced at low speeds, in order to take the reduced self-cooling of AC motors into account.

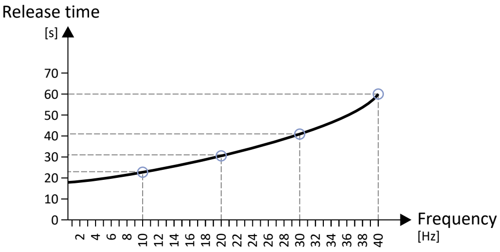
For UL-compliant operation, speed compensation must also be activated. 0x2D4B:002 = "On [0]".

If speed compensation is activated, the **maximum load ratio for continuous operation** is reduced as follows:

Calculation
Output frequency < 40 Hz: **Maximum load ratio for continuous operation** = 62.5 % + 37.5 % * output frequency [Hz] / 40 [Hz]
Output frequency ≥ 40 Hz: No reduction

The following diagram shows the reduced release time with activated speed compensation.

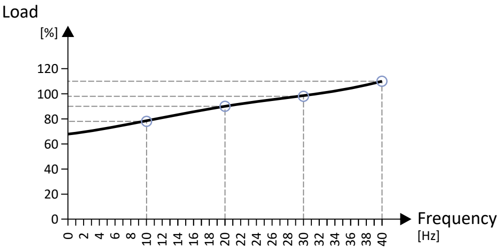
- Maximum utilization 0x2D4B:001 = 150 %
- Speed compensation 0x2D4B:002 = "On [0]"
- Load ratio = 150 %



Output frequency	Release time
40 Hz	60 s
30 Hz	≈ 41 s
20 Hz	≈ 31 s
10 Hz	≈ 23 s

The following diagram shows the possible permanent load with activated speed compensation without the monitoring being triggered.

- Maximum utilization 0x2D4B:001 = 150 %
- Speed compensation 0x2D4B:002 = "On [0]"



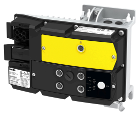
Output frequency	Possible permanent load
40 Hz	110 %
30 Hz	99 %
20 Hz	90 %
10 Hz	79 %

At of 0 Hz, only a load of max. 62.7 % (≈ 62.5 %) is possible. Reference: Load at 40 Hz (69 / 110 * 100 % = 62.7 %). The maximum possible motor load changes proportionally to the setting in 0x2D4B:001.

Calculation
Maximum load ratio for continuous operation at an output frequency < 40 Hz: Maximum load ratio for continuous operation = kf = 0.625 + 0.375/40 * output frequency
Release time at maximum load ratio for continuous operation: Release time at maximum load ratio for continuous operation [%] = 0.73 * kf * maximum utilization 0x2D4B:001
Release time at an output frequency < 40 Hz and a load ratio > **maximum load ratio for continuous operation**: Release time [s] ≈ 15.9 / ((load ratio/maximum utilization 0x2D4B:001 *kf)) – 0.724) [s]

Parameter

Address	Name / setting range / [default setting]	Information
0x2D4B:001	Motor overload monitoring (i^2xt): Maximum utilisation [60 s] 30 ... [**150**] ... 400 %	Maximum permissible thermal motor utilisation (max. permissible motor current for 60 seconds). • 100 % = Rated motor current 0x6075 • If the motor is actuated with the current set here for 60 seconds, the maximum permissible thermal motor utilisation is reached and the response set in 0x2D4B:003 is executed. • If the motor is actuated with a different current, the time period until the motor overload monitoring function is activated is different. Generally the following applies: the lower the current, the lower the thermal utilisation and the later the monitoring function is triggered.
0x2D4B:002	Motor overload monitoring (i^2xt): Speed compensation	Use this function to protect motors that are actuated at a speed below 40 Hz. • UL-compliant operation with motor overload protection requires the setting "On [0]"!
	0 **On**	Release time for motor overload monitoring is reduced in order to compensate for the reduced cooling of naturally ventilated AC induction motors during operation at low speed.
	1 Off	Function deactivated, no reduction of the motor overload monitoring release time. May require an external motor overload protection for the UL-compliant operation.
0x2D4B:003	Motor overload monitoring (i^2xt): Response	Selection of the response to the triggering of motor overload monitoring. • UL-compliant operation with motor overload protection requires the setting "error [3]"! • If monitoring is deactivated by the setting 0x2D4B:003 = "No response [0]", no motor overload protection is active. In this case, an external motor overload protection can be provided by the user for a UL-compliant operation. Associated error code: • 9040 | 0x2350 - CiA: i^2xt overload (thermal state)
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 **Fault**	
0x2D4B:005	Motor overload monitoring (i^2xt): Thermal load • Read only	Display of the value of the internal i^2*t integrator. • 37500 = 100 % thermal load • When power is switched off, this value is saved in the internal EEPROM. • When power is switched on, the saved value is reloaded into the i^2*t integrator. • The internal i^2*t integrator detects the thermal load based on the load conditions even if the motor overload monitoring is deactivated.
0x2D4F	Motor utilisation (i^2xt) • Read only: x %	Display of the current thermal motor utilisation.



10.8.2 Motor temperature monitoring

In order to record and monitor the motor temperature, a PTC thermistor (single sensor according to DIN 44081 or triple sensor according to DIN 44082) or thermal contact (normally-closed contact) can be connected to the terminals T1 and T2 (on the motor connector/X105 or X109). This measure helps to prevent the motor from being destroyed by overheating.

Preconditions

- The inverter can only evaluate one PTC thermistor! Do not connect several PTC thermistors in series or parallel.
- If several motors are actuated on one inverter, thermal contacts (NC contacts) (TCO) connected in series are to be used.
- To achieve full motor protection, an additional temperature monitoring function with a separate evaluation must be installed.

Details

If 1.6 kΩ < R < 4 kΩ at connections T1 and T2, the monitoring function will be activated; see functional test below.

- If the monitoring function is activated, the response set in 0x2D49:002 will be effected.
- The setting 0x2D49:002 = 0 deactivates the monitoring function.

If a suitable motor temperature sensor is connected to T1 and T2 and the response in 0x2D49:002 is set to "Fault [3]", the response of the motor overload monitoring may be set other than "Fault [3]" in 0x2D4B:003.
▶ Motor overload monitoring (i²xt) 176

Functional test

Connect a fixed resistor to the connections T1 and T2:

- R > 4 kΩ : The monitoring function must be activated.
- R < 1 kΩ : The monitoring function must not be activated.

Parameter

Address	Name / setting range / [default setting]		Information
0x2D49:002	Motor temperature monitoring: Response		Selection of the response to the triggering of the motor temperature monitoring. Associated error code: • 17168 | 0x4310 - Motor overtemperature
	0	No response	▶ Error types 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	**Fault**	

10.8.3 Overcurrent monitoring

This function monitors the instantaneous value of the motor current and serves as motor protection.

NOTICE

With an incorrect parameterization, the maximum permissible motor current may be exceeded in the process.

Possible consequences: Irreversible damage of the motor

Avoid motor damages by using the overcurrent monitoring function as follows:

- ▶ The setting of the threshold for the overcurrent monitoring in 0x2D46:001 must be adapted to the connected motor.
- ▶ Set the maximum current of the inverter in 0x6073 much lower than the threshold for overcurrent monitoring for a dynamic limitation of the motor current.

Details

The inverter monitors its output current. This monitoring is independent of the maximum overload current setting. ▶ Maximum overload current of the inverter 186

- If the instantaneous value of the motor current exceeds the threshold set in 0x2D46:001, the response set in 0x2D46:002 takes place.
- With the setting 0x2D46:002 = "No response [0]", the monitoring function is deactivated.

The threshold for the overcurrent monitoring is preset to four times the rated motor current. This presetting is overwritten in case a motor in the engineering tool is selected from the "motor catalog" or the automatic identification or calibration of the motor data is carried out. For a suitable protection, the automatically adapted setting should be used. If disturbances occur during operation, the value can be increased.

Parameter

Address	Name / setting range / [default setting]		Information
0x2D46:001	Overcurrent monitoring: Threshold 0.0 ... [**6.8**] ... 1000.0 A		Warning/error threshold for overcurrent monitoring of the motor. • If the active motor current exceeds the set threshold, the response set in 0x2D46:002 is triggered. • The parameter is calculated and set in the course of the automatic identification of the motor. • The parameter can also be set and overwritten by selecting a motor from the "motor catalogue" of the engineering tool or performing an automatic calibration of the motor. ▶ Options for optimizing the control loops 161
0x2D46:002	Overcurrent monitoring: Response		Selection of the response to the triggering of motor current monitoring. Associated error code: • 29056 | 0x7180 - Motor overcurrent
	0	No response	▶ Error types 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	**Fault**	

10.8.4 Motor phase failure detection

Parameter

Address	Name / setting range / [default setting]	Information
0x2D45:001	Motor phase failure detection: Response - Motor phase 1	Selection of the response following the detection of a motor phase failure during operation. Associated error codes: • 65289 | 0xFF09 - Motor phase missing • 65290 | 0xFF0A - Motor phase failure phase U • 65291 | 0xFF0B - Motor phase failure phase V • 65292 | 0xFF0C - Motor phase failure phase W
	0 **No response**	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	
0x2D45:002	Motor phase failure detection: Current threshold 1.0 ... [**5.0**] ... 25.0 %	Current threshold for the activation of the motor phase failure detection function. • 100 % = Rated motor current 0x6075 • Display of the present motor current in 0x2D88.
0x2D45:003	Motor phase failure detection: Voltage threshold 0.0 ... [**10.0**] ... 100.0 V	Voltage threshold for motor phase monitoring for the VFC control mode (0x2C00 = 6). • The monitoring function is triggered if the motor current exceeds the rated motor current-dependent current threshold for longer than 20 ms. Rated motor current 0x6075 • In case of the V/f characteristic control, the voltage threshold is considered additionally for the motor phase failure detection. If the motor voltage is higher than the voltage threshold, monitoring is combined with the motor current.

10.8.5 Motor speed monitoring

This function monitors the motor speed during operation.

Conditions

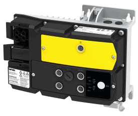
- In order to detect the current motor speed, the inverter must be enabled and the motor must rotate.
- For an exact monitoring, rated motor speed 0x2C01:004 and rated motor frequency 0x2C01:005 must be set correctly.
- For motor speed monitoring, it must be ensured that the speed limitation (0x6080 / max. motor speed) has a higher value than the actual monitoring (0x2D44:001).

Details

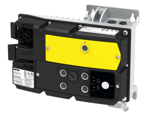
- If the motor speed reaches the threshold set in 0x2D44:001, the response set in 0x2D44:002 takes place.
- With the setting 0x2D44:002 = "No response [0]", the monitoring function is deactivated.

Parameter

Address	Name / setting range / [default setting]	Information
0x2D44:001	Overspeed monitoring: Threshold 50 ... [**8000**] ... 50000 rpm	Warning/error threshold for motor speed monitoring. • If the motor speed reaches the threshold set, the response selected in 0x2D44:002 takes place. • The parameter can be set and thus overwritten by selecting a motor in the engineering tool from the "motor catalog". • Depending on the parameter setting of 0x2D44:001 (Overspeed monitoring: threshold), the speed limitation (0x6080 / Max. motor speed) may become active before speed monitoring. ▸ Options for optimizing the control loops 📖 161



Address	Name / setting range / [default setting]		Information
0x2D44:002	Overspeed monitoring: Response		Selection of the response to the triggering of motor speed monitoring. Associated error code: • 65286 | 0xFF06 - Motor overspeed
	0	No response	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	**Fault**	



10.8.6 Motor torque monitoring

This function limits the motor torque during operation.

Preconditions

The motor torque monitoring can only be used for the following motor control types with speed controller:

- Servo control (SC ASM)
- Sensorless control (SL PSM)
- Sensorless vector control (SLVC)

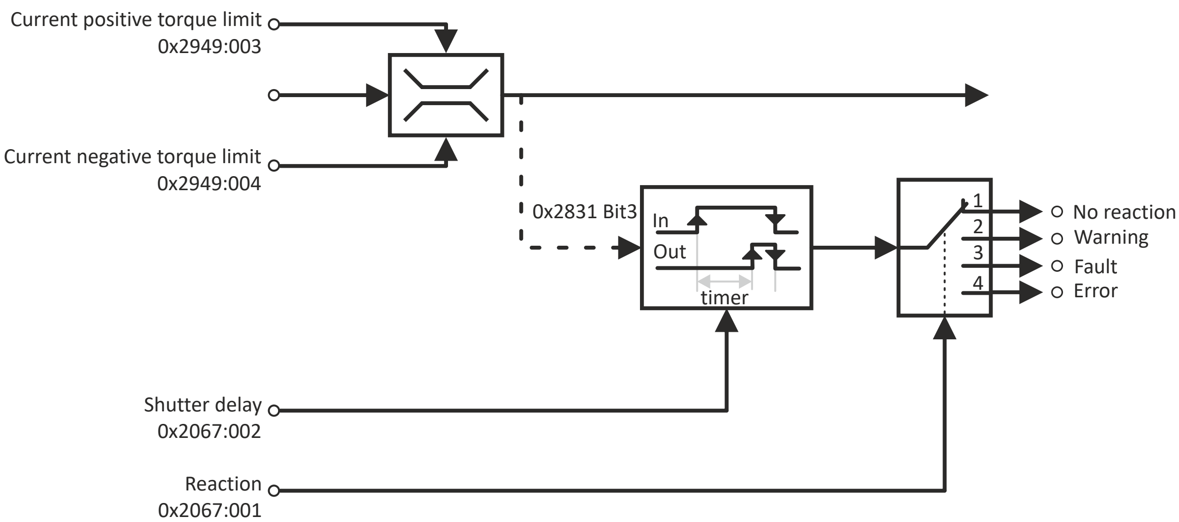
Details

This function sets the internal status signal "Torque limit reached [79]" = TRUE when the maximum possible torque has been reached.

The limits of the monitoring function are selected via 0x2949:001 (positive torque limit) and 0x2949:002 (negative torque limit). The actual limits can be seen in 0x2949:003 (actual positive torque limit), 0x2949:004 (actual negative torque limit).

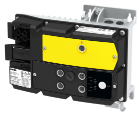
▶ Torque limits 📖 100

- The status signal is set irrespective of the response 0x2D67:001 and the delay time 0x2D67:002 set for this monitoring.
- The status signal can be used by the user to
  - activate certain functions. ▶ Flexible I/O configuration 📖 51
  - set a digital output. ▶ Configure digital outputs 📖 194
  - set a bit of the NetWordOUT1 mappable data word. ▶ Motor speed monitoring 📖 182



Parameter

Address	Name / setting range / [default setting]	Information
0x2D67:001	Maximum torque monitoring: Response	Selection of response to reaching the maximum possible torque. • The selected response takes place if the status signal "Torque limit reached [79]" = TRUE and the deceleration time set in 0x2D67:002 has elapsed. Associated error code: • 33553 | 0x8311 - Torque limit reached
	0 **No response**	▸ Error types 🕮 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	
0x2D67:002	Maximum torque monitoring: Triggering delay 0.000 ... [**0.000**] ... 10.000 s	Optional setting of a deceleration for triggering the response selected in 0x2D67:001. Typical application: • The motor should be driven at the torque limit for a short time without triggering the selected response. • Only after a longer operation (> set deceleration) at the torque limit, the selected response is to take place.
0x6072	Max. torque 0.0 ... [**250.0**] ... 3000.0 %	Symmetrical selection of the maximum permissible torque. • 100 % = Rated motor torque 0x6076 • This parameter serves to implement a static and bipolar torque limitation. This can be used, for instance, as overload protection of the mechanical transmission path/elements starting at the motor shaft. • This limitation acts irrespective of the torque limitations acting in unipolar mode that are set in 0x60E0 and 0x60E1.



10.8.7 Maximum overload current of the inverter

For the purpose of current limitation, a maximum overload current can be set for the inverter. If the current consumption of the motor exceeds this current limit, the inverter changes its dynamic behaviour, in order to counteract this exceedance.

Details

- The maximum current of the inverter can be set in 0x6073.
- Reference for the percentage setting of the maximum overload current is the rated motor current set in 0x6075.
- The actual motor current is displayed in 0x2D88.

If the change in the dynamic behavior carried out by the inverter does not result in exiting the overcurrent state, the inverter outputs an error.

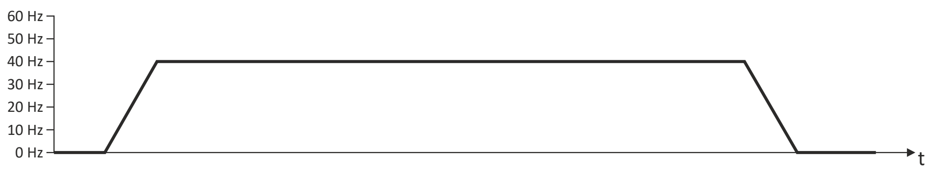
If 0x6078 (actual value in %) exceeds 0x6073 (max. actual value in %), a message 0x238A is displayed. The status is also indicated in the following network status word bits:

- 0x400C:001 bit 14
- 0x400C:002 bit 2

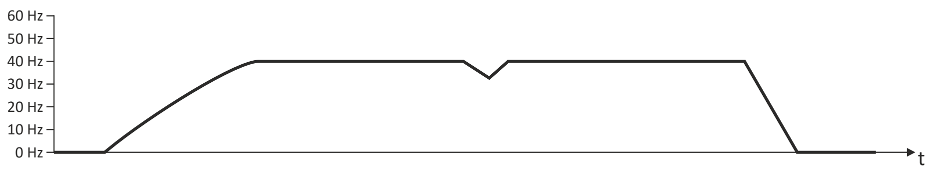
Load response	Impact
Overload during acceleration in motor mode	A longer time than is required for reaching the frequency setpoint is set.
Overload during deceleration in generator mode	A longer time than is required for reaching standstill is set.
Increasing load at constant frequency	If the motor current limit value is reached: • The inverter reduces the effective speed setpoint until a stable working point is set or an effective speed setpoint of 0 rpm is reached. • If the load is reduced, the inverter increases the effective speed setpoint until the setpoint speed is reached or the load reaches the current limit value again.
	When the generator current limit value is reached: • The inverter increases the effective speed setpoint until a stable working point is reached or up to the maximum permissible output frequency 0x2916. • If the load is reduced, the inverter reduces the effective speed setpoint until the setpoint speed is reached or the load reaches the current limit value again.
	If an abrupt load is building at the motor shaft (e.g. drive is blocked), the overcurrent switch-off function may respond.

Example: Overcurrent switch-off in case of a sudden load at the motor shaft

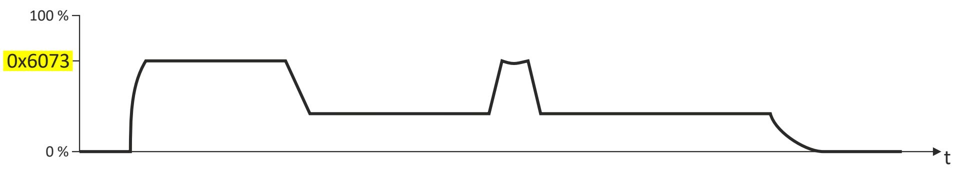
Frequency setpoint selection



Output frequency



Motor load



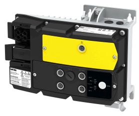
Parameter

Address	Name / setting range / [default setting]	Information
0x6073	Max. current 0.0 ... [**200.0**] ... 3000.0 %	Max. current of the inverter. • 100 % = Rated motor current (0x6075) • If the current consumption of the motor exceeds this current limit, the inverter changes its dynamic behaviour in order to counteract this exceedance. • If the modified dynamic behaviour fails to eliminate the excess current consumption, the inverter outputs an error. When 0x6078 (current actual value in %) exceeds 0x6073 (max. current actual value in %) the message 0x238A is displayed. This status is also displayed in the following network status word bits: • 0x400C:001 bit 14 • 0x400C:002 bit 2 Note! This parameter is not identical to the ultimate motor current I_{ULT}. • The value set in 0x2D46:001 (Threshold) is a limit value for synchronous motors to protect their magnets. • The value to be set here should always be considerably below the ultimate motor current.

10.8.8 Heavy load monitoring

Parameter

Address	Name / setting range / [default setting]		Information
0x4007:001	Heavy load monitoring: Error threshold 0.0 ... [**200.0**] ... 300.0 %		When the threshold value for the apparent current of the motor is exceeded, the delay time encoder is started. • 100 % = of rated motor current 0x6075
0x4007:002	Heavy load monitoring: Delay time 0.0 ... [**3.0**] ... 999.9 s		Setting of the delay time.
0x4007:003	Heavy load monitoring: Error response		Setting of the error response. Associated error code: • 65337 | 0xFF39 - Motor overload
	0	**No response**	▸ Error types 🕮 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	



11 I/O extensions and control connections

11.1 Configure function assignment

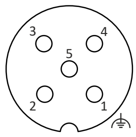
The control connections of the inverter are designed as configurable connectors. By default, all control connections are configured as digital inputs.

Prerequisites:

Connectors X3.3 and X3.4 are only available on the inverter with application I/O.

Details

The function assignment of the plug connectors X3 can be configured via the parameters listed below.

M12 connectors (A coded)	Pin	Assignment			
		X3.1	X3.2	X3.3	X3.4
	1	24 V or L+ (for IO-Link devices, only for application I/O)			
	2	DI2	configurable in 0x2630:011	DI6	DI8
	3	GND or L- (for IO-Link devices, only for application I/O)			
	4	configurable in 0x2630:010	configurable in 0x2630:011	configurable in 0x2630:012	configurable in 0x2630:013
	5	Not assigned			
	⏚	Housing is connected to functional earth			

Function assignment "DIx":

- Normal digital inputs for control tasks.
- Logic level "HIGH-active" or "LOW-active", debounce time, and inversion can be parameterized.

"DOx" function assignment:

- Normal digital outputs.
- Switch-on delay and switch-off delay can be parameterized.

"IO-Link" function assignment:

- For communicating with sensors and actuators (IO-Link devices) with port class A.
- The inverter (IO-Link master) supports IO-Link version 1.1

Function assignment "Encoder / Low-resolution HTL encoder":

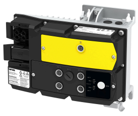
- To evaluate the signal of a low-cost HTL encoder for the feedback of the motor speed.

"Pulse-In" function assignment:

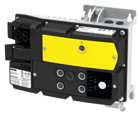
- To evaluate the signal of a low-cost HTL encoder or a reference frequency ("Pulse-Train") and to accept it as a setpoint signal.
- The detection of a direction signal ("Pulse-Direction") is also supported.

Parameter

Address	Name / setting range / [default setting]		Information
0x2630:010	Settings for digital inputs: Plug X3.1 configuration • Setting can only be changed if the inverter is disabled.		Function assignment of X3.1, pin 2 + pin 4.
	1	**DI2 + DI1**	▸ Configure digital inputs 🕮 190
	2	DI2 + DO1	▸ Configure digital outputs 🕮 194
	3	DI2 + IO-Link port 1	Only available for inverters with application I/O. ▸ Configure IO-Link ports 🕮 205
	4	DI2 + Pulse train	



Address	Name / setting range / [default setting]		Information
0x2630:011	Settings for digital inputs: Plug X3.2 configuration • Setting can only be changed if the inverter is disabled.		Function assignment of X3.2, pin 2 + pin 4.
	0	Encoder	For evaluating a single-track or dual-track HTL encoder (max. 200 kHz). • A single-track HTL encoder (track A) cannot be used for motor speed feedback. • A two-track HTL encoder (track A and B) must have a phase offset of exactly 90° between track A and B (error ≤ ± 10°). Inverted tracks are not required. • Encoder increments: ≤ 16384 increments per revolution. ▸ Configure encoder input 🕮 110
	1	**DI4 + DI3**	▸ Configure digital inputs 🕮 190
	2	DI4 + DO2	Only available for inverters with application I/O. ▸ Configure digital outputs 🕮 194
	3	DI4 + IO-Link port 2	Only available for inverters with application I/O. ▸ Configure IO-Link ports 🕮 205
	15	Low resolution HTL encoder	For the evaluation of a HTL encoder with low resolution (≤ 128 increments per revolution). • This evaluation method is suitable for encoders with poor signal quality, e.g. encoders with a high error rate in sampling ratio and phase offset. • The prerequisite is an equidistant period length per encoder increment. • An interruption of track A is not detected. ▸ Configure encoder input 🕮 110
	16	Pulse in + DI3	Only available for inverters with application I/O. ▸ Configure HTL input 🕮 199
	17	Pulse in + DO2	
	18	Pulse in + IO-Link port 2	
	19	Pulse in + Pulse direction	
0x2630:012	Settings for digital inputs: Plug X3.3 configuration • Setting can only be changed if the inverter is disabled.		Function assignment of X3.3, pin 2 + pin 4. Only available for inverters with application I/O.
	1	**DI6 + DI5**	▸ Configure digital inputs 🕮 190
	2	DI6 + DO3	▸ Configure digital outputs 🕮 194
	3	DI6 + IO-Link port 3	▸ Configure IO-Link ports 🕮 205
0x2630:013	Settings for digital inputs: Plug X3.4 configuration • Setting can only be changed if the inverter is disabled.		Function assignment of X3.4, pin 2 + pin 4. Only available for inverters with application I/O.
	1	**DI8 + DI7**	▸ Configure digital inputs 🕮 190
	2	DI8 + DO4	▸ Configure digital outputs 🕮 194
	3	DI8 + IO-Link port 4	▸ Configure IO-Link ports 🕮 205



11.2 Configure digital inputs

With the "DIx" function assignment for the X3 connectors, the inverter provides normal digital inputs. These inputs can be used for control tasks.

Prerequisites:

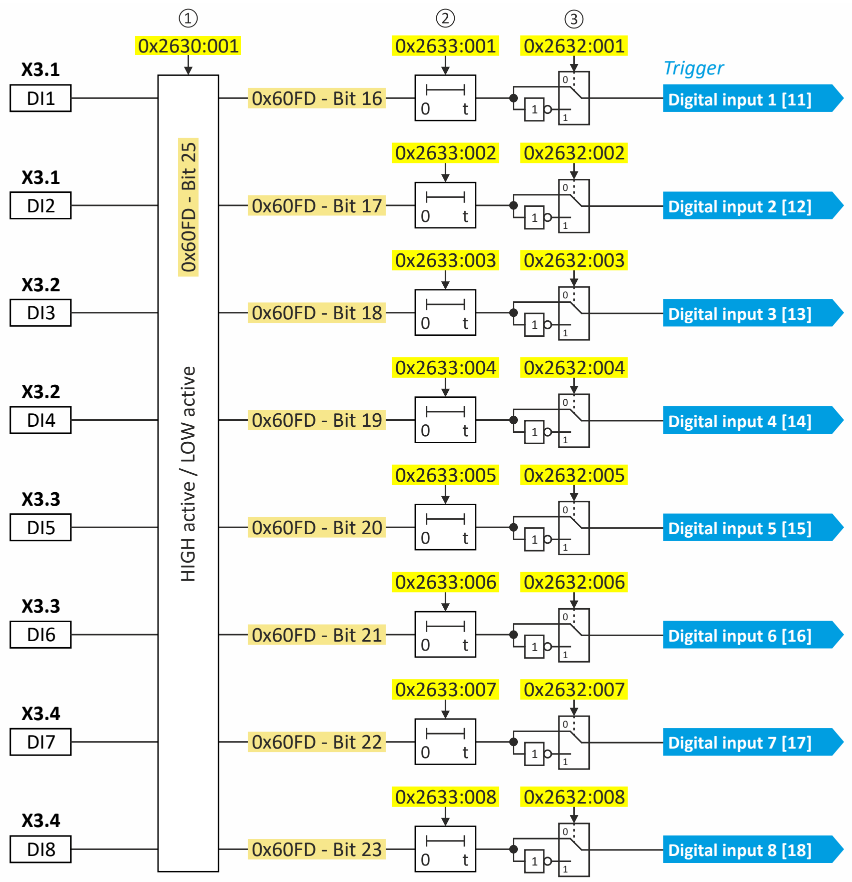
- The function assignment of the connectors must be configured accordingly. ▶ Configure function assignment 📖 188
- The digital inputs 5 ... 8 (DI5 ... DI8) are only available for inverters with application I/O.

Details

The digital inputs are used for control tasks. For this purpose, the digital inputs are available as selectable triggers for functions.

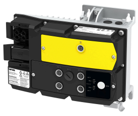
The following settings are possible for the digital inputs:

- Logic level "HIGH active" or "LOW active" ①
- Debounce time ②
- Inversion ③



Diagnostic parameters:

- The logic status of the digital inputs is displayed in 0x60FD.



Logic level "HIGH active" or "LOW active"

The digital inputs can be configured in 0x2630:001 HIGH active (default setting) or LOW active:

HIGH active (default setting):

- Internally, the digital input terminals are set to LOW level via pull-down resistors.
- The current flows from the current supply (e.g. terminal X3/24 V) through the contact to the digital input terminal (and internally via the pull-down resistor to GND).
- If the contact is closed, the digital input is set to HIGH level and is thus HIGH active.

LOW active:

- Internally, the digital input terminals are set to HIGH level via pull-up resistors.
- The current flows from the digital input terminal through the contact to GND.
- If the contact is closed, the digital input is set to LOW level and is thus LOW active.

Debounce time

For minimizing interference pulses, a debounce time of 1 ms is set for all digital inputs.
Via »EASY Starter« (or network), the debounce time for can be increased individually for each digital input to max. 50 ms.

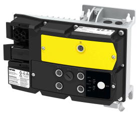
Inversion

Each digital input can be configured in such a way that the state pending at the terminal is logically inverted internally. This way, a closed contact, for instance, serves to deactivate an assigned function instead of activating it. In this way, the control of the inverter can be flexibly adapted to the needs of the actual application.

Parameter

Address	Name / setting range / [default setting]		Information
0x2630:001	Settings for digital inputs: Assertion level		Definition of the internal hardware interconnection of the digital inputs.
	0	LOW active	Digital inputs are internally set to HIGH level via pull-up resistors.
	1	**HIGH active**	Digital inputs are internally set to LOW level via pull-down resistors.
0x2632:001	Inversion of digital inputs: Digital input 1		Inversion of digital input 1
	0	**Not inverted**	
	1	Inverted	
0x2632:002	Inversion of digital inputs: Digital input 2		Inversion of digital input 2
	0	**Not inverted**	
	1	Inverted	
0x2632:003	Inversion of digital inputs: Digital input 3		Inversion of digital input 3
	0	**Not inverted**	
	1	Inverted	
0x2632:004	Inversion of digital inputs: Digital input 4		Inversion of digital input 4
	0	**Not inverted**	
	1	Inverted	
0x2632:005	Inversion of digital inputs: Digital input 5		Inversion of digital input 5
	0	**Not inverted**	
	1	Inverted	
0x2632:006	Inversion of digital inputs: Digital input 6		Inversion of digital input 6
	0	**Not inverted**	
	1	Inverted	
0x2632:007	Inversion of digital inputs: Digital input 7		Inversion of digital input 7
	0	**Not inverted**	
	1	Inverted	
0x2632:008	Inversion of digital inputs: Digital input 8		Inversion of digital input 8
	0	**Not inverted**	
	1	Inverted	
0x2633:001	Digital input debounce time: Digital input 1 1 ... [**1**] ... 50 ms		Debounce time of digital input 1
0x2633:002	Digital input debounce time: Digital input 2 1 ... [**1**] ... 50 ms		Debounce time of digital input 2

Address	Name / setting range / [default setting]	Information
0x2633:003	Digital input debounce time: Digital input 3 1 ... [**1**] ... 50 ms	Debounce time of digital input 3
0x2633:004	Digital input debounce time: Digital input 4 1 ... [**1**] ... 50 ms	Debounce time of digital input 4
0x2633:005	Digital input debounce time: Digital input 5 1 ... [**1**] ... 50 ms	Debounce time of digital input 5
0x2633:006	Digital input debounce time: Digital input 6 1 ... [**1**] ... 50 ms	Debounce time of digital input 6
0x2633:007	Digital input debounce time: Digital input 7 1 ... [**1**] ... 50 ms	Debounce time of digital input 7
0x2633:008	Digital input debounce time: Digital input 8 1 ... [**1**] ... 50 ms	Debounce time of digital input 8
0x4015:001	Digital input status: Level of digital input 1 • Read only	Display of the level at the digital input.
0x4015:002	Digital input status: Level of digital input 2 • Read only	
0x4015:003	Digital input status: Level of digital input 3 • Read only	
0x4015:004	Digital input status: Level of digital input 4 • Read only	
0x4015:005	Digital input status: Level of digital input 5 • Read only	
0x4015:006	Digital input status: Level of digital input 6 • Read only	
0x4015:007	Digital input status: Level of digital input 7 • Read only	
0x4015:008	Digital input status: Level of digital input 8 • Read only	
0x4015:017	Digital input status: Level from digital input 1 • Read only	Display of the level at the digital input, taking into account any inversion that may have been set.
0x4015:018	Digital input status: Level from digital input 2 • Read only	
0x4015:019	Digital input status: Level from digital input 3 • Read only	
0x4015:020	Digital input status: Level from digital input 4 • Read only	
0x4015:021	Digital input status: Level from digital input 5 • Read only	
0x4015:022	Digital input status: Level from digital input 6 • Read only	
0x4015:023	Digital input status: Level from digital input 7 • Read only	
0x4015:024	Digital input status: Level from digital input 8 • Read only	



Example: Activating two functions simultaneously via digital input 4

The principle of assigning triggers to functions also enables a digital input to be assigned to several functions. The wiring complexity is reduced since there is no necessity to interconnect several digital inputs.

If, for instance, the frequency preset 1 is to be selected via the digital input 4 and a change-over to the acceleration time 2 and deceleration time 2 is to take place at the same time, this can be easily realised by the following parameter setting:

Parameter	Designation	Setting for this example
0x2631:018	Activate preset (bit 0)	Digital input 4 [14]
0x2631:039	Activate ramp 2	Digital input 4 [14]

In order to achieve the desired behaviour, the digital input 4 must not be assigned to any further functions!

11.3 Configure digital outputs

With the "DOx" function assignment for the X3 connectors, the inverter provides normal digital outputs.

Prerequisites:

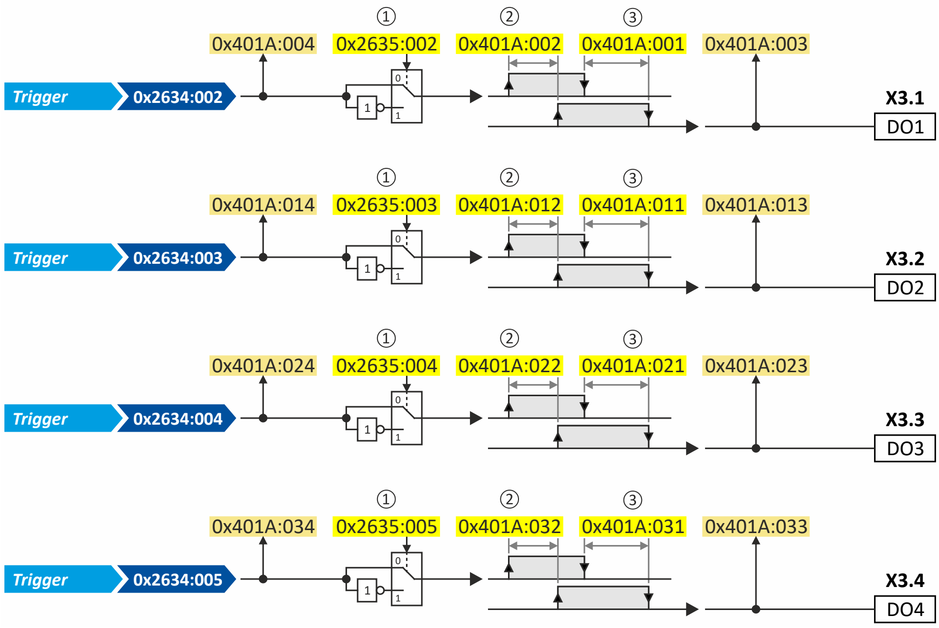
- The function assignment of the connectors must be configured accordingly. ▶ Configure function assignment 📖 188
- The digital outputs 2 ... 4 (DO2 ... DO4) are only available for inverters with application I/O.

Details

The digital outputs are controlled by the triggers selected in 0x2634:002 ... 0x2634:005 are used to control the digital outputs.

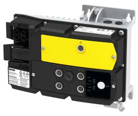
The following settings are possible for the digital outputs:

- Inversion ①
- Switch-on delay ②
- Cutout delay ③

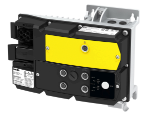


Parameter

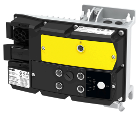
Address	Name / setting range / [default setting]		Information
0x2634:002	Digital outputs function: Digital output 1		Assignment of a trigger to digital output 1. Trigger = FALSE: X3/DO1 set to LOW level. Trigger = TRUE: X3/DO1 set to HIGH level. Notes: • An inversion set in 0x2635:002 is taken into consideration here.
	0	Not connected	No trigger assigned (trigger is constantly FALSE).
	1	Constant TRUE	Trigger is constantly TRUE.
	11	Digital input 1	State of X3/DI1, taking an inversion set in 0x2632:001 into consideration.
	12	Digital input 2	State of X3/DI2, taking an inversion set in 0x2632:002 into consideration.
	13	Digital input 3	State of X3/DI3, taking an inversion set in 0x2632:003 into consideration.
	14	Digital input 4	State of X3/DI4, taking an inversion set in 0x2632:004 into consideration.
	15	Digital input 5	State of X3/DI5, taking an inversion set in 0x2632:005 into consideration.
	16	Digital input 6	State of X3/DI6, taking an inversion set in 0x2632:006 into consideration.
	17	Digital input 7	State of X3/DI7, taking an inversion set in 0x2632:007 into consideration.
	18	Digital input 8	State of X3/DI8, taking an inversion set in 0x2632:008 into consideration.



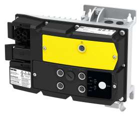
Address	Name / setting range / [default setting]		Information
	30	NetWordIN1 - bit 12	State of NetWordIN1/bit 12 ... 15. • Display of NetWordIN1 in 0x4008:001. • For implementing an individual control word format, NetWordIN1 can be mapped to a process data input word.
	31	NetWordIN1 - bit 13	
	32	NetWordIN1 - bit 14	
	33	NetWordIN1 - bit 15	
	34	NetWordIN2 - bit 0	State of NetWordIN2/bit 0 ... bit 15. • Display of NetWordIN2 in 0x4008:002. • For controlling the digital outputs via network, NetWordIN2 can be mapped to a process data input word.
	35	NetWordIN2 - bit 1	
	36	NetWordIN2 - bit 2	
	37	NetWordIN2 - bit 3	
	38	NetWordIN2 - bit 4	
	39	NetWordIN2 - bit 5	
	40	NetWordIN2 - bit 6	
	41	NetWordIN2 - bit 7	
	42	NetWordIN2 - bit 8	
	43	NetWordIN2 - bit 9	
	44	NetWordIN2 - bit 10	
	45	NetWordIN2 - bit 11	
	46	NetWordIN2 - bit 12	
	47	NetWordIN2 - bit 13	
	48	NetWordIN2 - bit 14	
	49	NetWordIN2 - bit 15	
	50	Running	TRUE if inverter and start are enabled and output frequency > 0 Hz. Otherwise FALSE. Exception, quick stop mode: TRUE if inverter and start are enabled and output frequency > 0.2 Hz. Otherwise FALSE.
	51	Ready for operation	TRUE if inverter is ready for operation (no error active, no STO active and DC-bus voltage ok). Otherwise FALSE.
	52	**Operation enabled**	TRUE if inverter and start are enabled. Otherwise FALSE.
	53	Stop active	TRUE if inverter is enabled and motor is not started and output frequency = 0.
	54	Quick stop active	TRUE if quick stop is active. Otherwise FALSE.
	55	Inverter disabled (safety)	TRUE if the integrated safety system has inhibited the inverter. Otherwise FALSE. ▶ Safe torque off (STO) 📖 427
	56	Fault active	TRUE if error is active. Otherwise FALSE.
	57	Error (non-resettable) active	TRUE if non-resettable error is active. Otherwise FALSE.
	58	Device warning active	TRUE if warning is active. Otherwise FALSE. • A warning has no impact on the operating status of the inverter. • A warning is reset automatically if the cause has been eliminated.
	59	Device trouble active	TRUE if a fault is active. Otherwise FALSE. • In the event of a fault, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. • Exception: In case of a serious fault, the inverter is disabled immediately. The motor has no torque (coasts). • The error state will be left automatically if the error condition is not active anymore. • The restart behaviour after trouble can be configured. ▶ Automatic restart after a fault 📖 399
	60	Heatsink temperature warning active	TRUE if current heatsink temperature > warning threshold for temperature monitoring. Otherwise FALSE. • Display of the current heatsink temperature in 0x2D84:001. • Setting of the warning threshold in 0x2D84:002.
	65	Motor PTC error active	TRUE if an error of the motor PTC has been detected. Otherwise FALSE. • The trigger is set irrespective of the response set in 0x2D49:002 when the motor temperature monitoring is triggered. ▶ Motor temperature monitoring 📖 180
	66	Flying restart circuit active	TRUE if flying restart circuit active is active. Otherwise FALSE. ▶ Flying restart circuit 📖 133



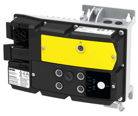
Address	Name / setting range / [default setting]		Information
	67	DC braking active	TRUE if DC braking is active. Otherwise FALSE. ▸ DC braking 145
	68	Stop command active	TRUE if delay to standstill active. Otherwise FALSE.
	69	Rotational direction reversed	TRUE if output frequency is negative. Otherwise FALSE.
	70	Frequency threshold exceeded	TRUE if current output frequency > frequency threshold. Otherwise FALSE. • Display of the current output frequency in 0x2DDD. • Setting Frequency threshold in 0x4005. ▸ Trigger action if a frequency threshold is exceeded 421
	71	Actual speed = 0	TRUE if actual output frequency = 0 Hz (± 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD.
	72	Setpoint speed reached	TRUE if frequency setpoint reached. Otherwise FALSE.
	73	PID feedback = setpoint	TRUE if the controlled feedback variable = process controller setpoint (± in 0x404D:003 set hysteresis). Otherwise FALSE. ▸ Configuring the process controller 80
	74	PID sleep mode active	TRUE if the inverter is in "PID sleep mode". Otherwise FALSE. ▸ Process controller sleep mode 87
	75	PID MIN alarm active	TRUE if feedback variable (with activated PID control) < MIN alarm threshold. Otherwise FALSE. • Setting of MIN alarm threshold in 0x404D:001. ▸ Configuring the process controller 80
	76	PID MAX alarm active	TRUE if the feedback variable (with activated PID control) > MAX alarm threshold. Otherwise FALSE. • Setting of MAX alarm threshold in 0x404D:002. ▸ Configuring the process controller 80
	77	PID MIN-MAX alarm active	TRUE if no PID alarm is active with activated PID control (MIN alarm threshold < feedback variable < MAX alarm threshold). Otherwise FALSE. • Setting of MIN alarm threshold in 0x404D:001. • Setting of MAX alarm threshold in 0x404D:002. ▸ Configuring the process controller 80
	78	Current limit reached	TRUE if current motor current ≥ maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88. • Setting for the maximum current in 0x6073.
	79	Torque limit reached	TRUE if torque limit has been reached or exceeded. Otherwise FALSE. • Setting "Actual positive torque limit" in 0x2949:003. • Setting "Actual negative torque limit" in 0x2949:004. ▸ Motor torque monitoring 184
	83	Load loss detected	TRUE if actual motor current < threshold for load loss detection after delay time of the load loss detection has elapsed. Otherwise FALSE. • Display of the actual current in 0x6078. • Setting Threshold in 0x4006:001. • Setting Delay time in 0x4006:002. ▸ Load loss detection 160
	84	Heavy load monitoring	TRUE if the actual apparent current of the motor exceeds the threshold for longer than the delay time. FALSE if the actual apparent current of the motor falls below the threshold value minus 5 % (hysteresis). ▸ Heavy load monitoring 187
	108	Parameter set 1 active	TRUE if parameter set 1 is loaded and active. Otherwise FALSE.
	109	Parameter set 2 active	TRUE if parameter set 2 is loaded and active. Otherwise FALSE.
	110	Parameter set 3 active	TRUE if parameter set 3 is loaded and active. Otherwise FALSE.
	111	Parameter set 4 active	TRUE if parameter set 4 is loaded and active. Otherwise FALSE.
	112	Parameter set load OK	TRUE after any parameter set has been loaded. Otherwise FALSE.
	113	Parameter set load fail	TRUE if any of the parameter sets could not be loaded. Otherwise FALSE.



Address	Name / setting range / [default setting]		Information
	115	Release holding brake	Trigger signal for releasing the holding brake (TRUE = release holding brake). Note! If this trigger is assigned to the relay or a digital output, the deceleration times set for the respective output are not effective (are internally set to "0"). Only the deceleration time set in 0x2820:012 for closing the holding brake influences in this case the time-dependent behaviour of the output. ▸ Holding brake control 📖 152
	117	Motor phase failure	TRUE if a motor phase failure has been detected. Otherwise FALSE. Note! In the "SLSM-PSM" motor control mode, detection for motor phase failure is deactivated if HF injection is active in the low-speed range. ▸ Motor phase failure detection 📖 182
	119	Holding brake released	TRUE, if holding brake is released. Otherwise FALSE. ▸ Holding brake control 📖 152
	155	STO active	TRUE if the integrated safety system has triggered the "Safe torque off (STO)" function and if the safe inputs SIA and SIB = LOW (simultaneously). Otherwise FALSE. ▸ Safe torque off (STO) 📖 427
0x2634:003	Digital outputs function: Digital output 2 • For further possible settings, see parameter 0x2634:002. 📖 194		Assignment of a trigger to digital output 2. Trigger = FALSE: X3/DO2 set to LOW level. Trigger = TRUE: X3/DO2 set to HIGH level. Notes: • An inversion set in 0x2635:003 is taken into consideration here.
	56	**Fault active**	TRUE if error is active. Otherwise FALSE.
0x2634:004	Digital outputs function: Digital output 3 • For further possible settings, see parameter 0x2634:002. 📖 194		Assignment of a trigger to digital output 3. Trigger = FALSE: X3/DO3 set to LOW level. Trigger = TRUE: X3/DO3 set to HIGH level. Notes: • An inversion set in 0x2635:004 is taken into consideration here.
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2634:005	Digital outputs function: Digital output 4 • For further possible settings, see parameter 0x2634:002. 📖 194		Assignment of a trigger to digital output 4. Trigger = FALSE: X3/DO4 set to LOW level. Trigger = TRUE: X3/DO4 set to HIGH level. Notes: • An inversion set in 0x2635:005 is taken into consideration here.
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2635:002	Inversion of digital outputs: Digital output 1		Inversion of digital output 1
	0	**Not inverted**	
	1	Inverted	
0x2635:003	Inversion of digital outputs: Digital output 2		Inversion of digital output 2
	0	**Not inverted**	
	1	Inverted	
0x2635:004	Inversion of digital outputs: Digital output 3		Inversion of digital output 3
	0	**Not inverted**	
	1	Inverted	
0x2635:005	Inversion of digital outputs: Digital output 4		Inversion of digital output 4
	0	**Not inverted**	
	1	Inverted	



Address	Name / setting range / [default setting]	Information
0x401A:001	Digital output configuration: DO1 switch-off delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:002	Digital output configuration: DO1 switch-on delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:003	Digital output configuration: DO1 terminal state • Read only	
0x401A:004	Digital output configuration: DO1 trigger signal state • Read only	
0x401A:011	Digital output configuration: DO2 switch-off delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:012	Digital output configuration: DO2 switch-on delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:013	Digital output configuration: DO2 terminal state • Read only	
0x401A:014	Digital output configuration: DO2 trigger signal state • Read only	
0x401A:021	Digital output configuration: DO3 switch-off delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:022	Digital output configuration: DO3 switch-on delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:023	Digital output configuration: DO3 terminal state • Read only	
0x401A:024	Digital output configuration: DO3 trigger signal state • Read only	
0x401A:031	Digital output configuration: DO4 switch-off delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:032	Digital output configuration: DO4 switch-on delay 0.000 ... [**0.000**] ... 65.535 s	
0x401A:033	Digital output configuration: DO4 terminal state • Read only	
0x401A:034	Digital output configuration: DO4 trigger signal state • Read only	



11.4 Configure HTL input

With the "Pulse-In" function assignment for connector X3.2, the inverter provides an HTL input. Via this input, the inverter can evaluate the signal of a low-cost HTL encoder or a reference frequency ("pulse train") and accept it as a setpoint signal. The detection of a direction signal ("Pulse-Direction") is also supported.

Prerequisites:

- The function assignment of the X3.2 connector must be configured accordingly.
  ▸ Configure function assignment 🕮 188
- The "Pulse-In" and "Pulse-Direction" functions are only available for inverters with application I/O.

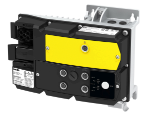
To be able to use the HTL input as a setpoint source, the input frequency must be connected to the additional function "Analog signal scaling".

In the default setting, the input frequency is already set as input value for the scaling "Analog signal 1".

▸ Example: Use HTL input as setpoint source 🕮 202

If the HTL encoder is to be used as a motor encoder for feedback of the motor speed for the most accurate speed control, connector X3.2 must be configured as an encoder input instead.

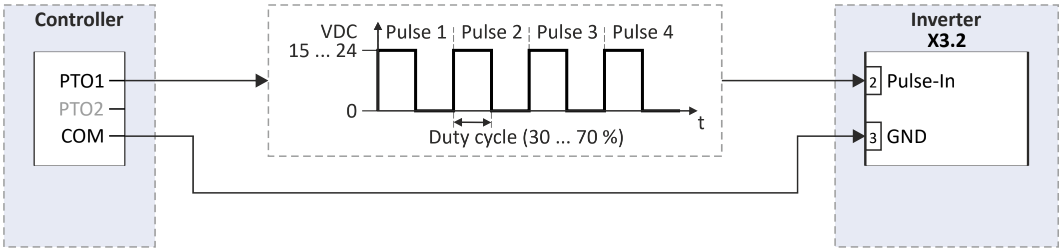
▸ Configuring the feedback system 🕮 109



Details

a) Pulse-In" function without "Pulse-Direction" (0x2630:011 = selection 16, 17, 18):

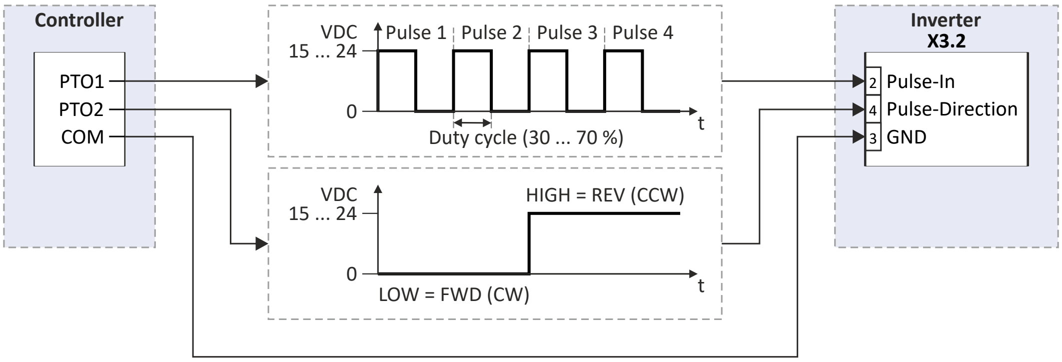
The frequency input signal (pulse train) is acquired via pin 2 of X3.2.



b) Pulse-In + Pulse-Direction" function (0x2630:011 = selection 19):

The frequency input signal (pulse train) is acquired via pin 2 of X3.2.

The direction signal is also acquired via pin 4 of X3.2.



Input frequency

The current input frequency is displayed in 0x2642:001. If pin 4 is used to detect the direction signal, the value of the input frequency becomes negative depending on the pulse train or direction signal!

Filter

The input frequency is filtered. The filter time constant is adjustable. ▸ 0x2640:009

Monitoring

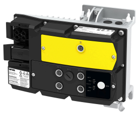
In addition, it is possible for the inverter to monitor the HTL input and generate a response when the input frequency falls below and/or rises above a predetermined frequency value.

Configuration of inverter monitoring:

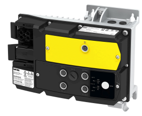
- Set minimum frequency threshold to the lowest valid input frequency (in Hz). ▸ 0x2641:001
- Set maximum frequency threshold to the highest valid input frequency (in Hz). ▸ 0x2641:003
- Set minimum delay threshold to the amount of time the input frequency must fall below the minimum threshold to cause an error condition. ▸ 0x2641:002
- Set maximum delay threshold to the amount of time that the input frequency must rise above the maximum threshold to cause an error condition. ▸ 0x2641:004
- Set monitoring conditions. ▸ 0x2641:005
- Set error response. ▸ 0x2641:006

Parameter

Address	Name / setting range / [default setting]	Information
0x2640:009	HTL input settings: Filter time constant 0 ... **[10]** ... 10000 ms	PT1 time constant for low-pass filter.



Address	Name / setting range / [default setting]	Information
0x2641:001	HTL input monitoring: Minimum frequency threshold -214748364.8 ... [**0.0**] ... 214748364.7 Hz	Settings for the minimum frequency threshold for the monitoring of the HTL input.
0x2641:002	HTL input monitoring: Minimum delay threshold 0.0 ... [**5.0**] ... 300.0 s	Settings for the minimum deceleration threshold for the monitoring of the HTL input.
0x2641:003	HTL input monitoring: Maximum frequency threshold -214748364.8 ... [**0.0**] ... 214748364.7 Hz	Settings for the maximum frequency threshold for the monitoring of the HTL input.
0x2641:004	HTL input monitoring: Maximum delay threshold 0.0 ... [**5.0**] ... 300.0 s	Settings for the maximum deceleration threshold for the monitoring of the HTL input.
0x2641:005	HTL input monitoring: Monitoring conditions	Monitoring condition for HTL input. • If the selected condition is fulfilled, the response set in 0x2641:006 takes place.
	1 Below minimum frequency	Input frequency < minimum frequency threshold 0x2641:001 longer than the deceleration 0x2641:002.
	2 Above maximum frequency	Input frequency > maximum frequency threshold 0x2641:003 longer than the deceleration 0x2641:004.
	3 Below min. or above max. frequency	Input frequency < minimum frequency threshold 0x2641:001 longer than the deceleration 0x2641:002 OR input frequency > maximum frequency threshold 0x2641:003 longer than the deceleration 0x2641:004.
0x2641:006	HTL input monitoring: Error response	Selection of the response to the triggering of the HTL input monitoring. Associated error code: • 28803 | 0x7083 - HTL input fault
	0 No response	▸ Error types 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	
0x2642:001	HTL input diagnostics: Input frequency • Read only: x.x Hz	Display of the current input value at the HTL input.



11.4.1 Example: Use HTL input as setpoint source

For this example, we imagine the following use case: We have two motors and two inverters. One motor is to follow the other.

Solution: There is an HTL encoder mounted on the first motor, which is connected to X3.2 on the second inverter. X3.2 is configured as HTL input so that the input frequency can be used as frequency setpoint for the second motor.

- The example applies to an HTL encoder with 128 increments.
- Scaling of the input frequency and provision as a selectable frequency setpoint is performed via the additional function "Analog signal scaling". 406
- By default, the scaling for "Analog signal 1" is preset to be used for the frequency input.

Required wiring (second inverter)

- Track A of the HTL encoder is connected to X3.2/Pin 4.
- Track B of the HTL encoder is connected to X3.2/Pin 2.

Parameterization (second inverter)

1. Set function for connector X3.2: 0x2630:011 = "Pulse in + Pulse direction [19]"
2. Adjust scaling for "Analog signal 1".

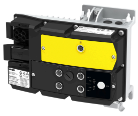
   The following presets can be kept:
   - 0x2654:001: Input value = input frequency (0x2642:001)
   - 0x2654:005: Input value is signed
   - 0x2654:006: Length of the input value = 32 bits
   - 0x2654:009: Output value is signed
   - 0x2654:010: Length of the output value = 32 bits

   The following settings must be made by the user:
   - 0x2654:007 / 0x2654:008: -32000/32000 (min./max. input value)
     → max. frequency = (max. speed [rpm] / 60) * increments
     → max. frequency = (1500 / 60) * 128 = 3200 Hz
     (note: The input frequency is scaled with 0.1).
   - 0x2654:011 / 0x2654:012: -5000/5000 (min./max. output value) → -50 Hz/50 Hz
     (note: The internal frequency value is scaled with 0.01).
3. To apply the settings made, set "Active [1]" in 0x2654:015.
4. Set output signal of scaling "Analog signal 1" as setpoint source for frequency control:
   0x2860:001 = "Scaling1 value [230]"

After enabling both inverters, both motors should run at the same speed.

Notes

As an alternative to the direct selection of "Scaling1 value [230]" in 0x2860:001, the scaled value can be mapped to any other mappable parameter by setting a target address in0x2654:003. For example, if the scaled value is mapped to 0x400B:003 ...005, then the selection "Network [5]" must be set in 0x2860:001. In this case, the minimum/maximum output value must be adjusted to the scaling factor of the mapped parameter.



11.5 Configure HTL output

With the “pulse train" function assignment for connector X3.1, the inverter provides an HTL output. The inverter can output a reference frequency ("pulse train") via this output. Other inverters can interpret this signal as a setpoint signal, for example.

Preconditions

- The function assignment of the X3.1 connector must be configured accordingly.
  ▶ Configure function assignment 📖 188
- The "Pulse Train" function is available for all device variants.

For the output of an internal variable, the HTL output must be connected to the additional function "Analog signal scaling".
▶ Example: Output scalable analog signal at HTL output 📖 204

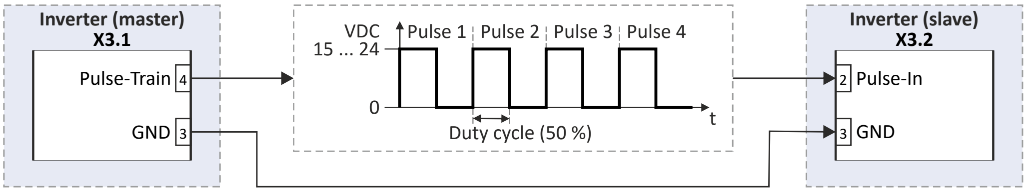
Restrictions

- The maximum output frequency of the HTL output is 10 kHz.

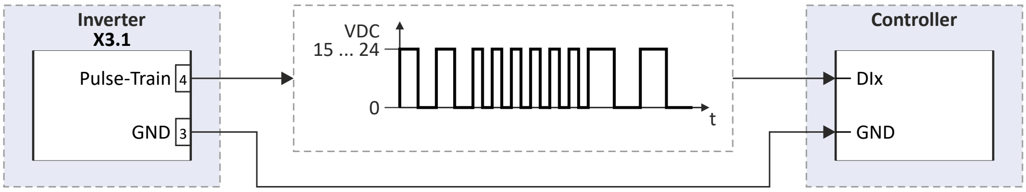
Details

Typical applications:

a) An inverter acts as a master and transfers its actual output frequency in the form of a pulse train signal to one or several other inverters (slaves). The slaves use the pulse train signal with a corresponding scaling as a frequency setpoint.

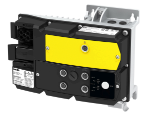


b) The inverter transmits the current torque or another internal variable as a pulse train signal to a higher-level controller. The controller can then evaluate the signal accordingly.



Parameter

Address	Name / setting range / [default setting]		Information
0x2644:003	DO1 frequency setup: Function		Selection of the signal to be provided at the digital output 1 as pulse train.
	0	**Not active**	No output signal.
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▶ Configure function assignment 📖 188 ▶ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▶ Analog signal scaling 📖 406
	231	Scaling2 value	



Address	Name / setting range / [default setting]	Information
0x2646:001	DO actual frequency: Digital output 1 • Read only: x.x Hz	Display of the current frequency of the pulse train signal at the digital output 1.

11.5.1 Example: Output scalable analog signal at HTL output

For this example, we imagine the following use case: We have two motors and two inverters. One motor is to follow the other.

Solution: The current output frequency of the first inverter is output via the HTL output. The HTL output is connected to the HTL input of the second inverter so that it can use the input frequency as the frequency setpoint for the second motor.

- The output frequency is scaled via the “Analog signal 2" of the additional function "Analog signal scaling". 🕮 406
- The " Analog signal 2 " is again assigned to the HTL output as a signal source.

Required wiring

- The HTL output (X3.1/Pin 4) of the first inverter is connected to the HTL input (X3.2/Pin 2) of the second inverter.

Parameterization (first inverter)

1. Set function for connector X3.1: 0x2630:010 = "DI2 + Pulse train [4]"
2. Make the following settings for "Analog signal 2":
   - 0x2654:016: Input value = "0x2DDD0010" (current output frequency 0x2DDD)
   - 0x2654:020: Input value is signed [0]
   - 0x2654:024: Output value is signed [0]
   - 0x2654:025: Length of the output value = 32 bits

   If scaling is required, it can be set via the following parameters:
   - 0x2654:022/0x2654:023: min./max. input value
   - 0x2654:026/0x2654:027: min./max. output value
3. To apply the settings made, set "Active [1]" in 0x2654:030.
4. Set output signal of scaling "Analog signal 2" for the HTL output: 0x2644:003 = "Scaling2 value [231]"

Parameterization (second inverter)

Configure the HTL input on the second inverter.

For details, see ▸ Example: Use HTL input as setpoint source 🕮 202

11.6 Configure IO-Link ports

With the "IO-Link" function assignment for the X3 plug connectors, the inverter provides IO-Link ports. These ports are used for communication with sensors and actuators (IO-Link devices) with port class A.

Prerequisites:

- The function assignment of the connectors must be configured accordingly. ▸ Configure function assignment 📖 188
- The IO-Link ports are only available on the inverter with application I/O.

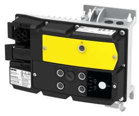
Details

The inverter (IO-Link master) supports IO-Link version 1.1

11.6.1 Basic setting and options

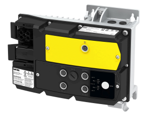
Parameter

Address	Name / setting range / [default setting]		Information
0x24A1:011	IO-Link port 1: Vendor ID 0 ... [**0**] ... 65535		
0x24A1:012	IO-Link port 1: Device ID 0 ... [**0**] ... 16777215		
0x24A1:013	IO-Link port 1: Validation method		
	0	**No check**	
	1	Type compatible	
0x24A1:014	IO-Link port 1: Backup method		
	0	**No data storage**	
	1	Backup and restore	
	2	Restore	
0x24A1:015	IO-Link port 1: Revision ID		
	0	No check	
	16	Revision V1.0	
	17	Revision V1.1	
0x24A1:016	IO-Link port 1: Cycle time 0.0 ... [**0.0**] ... 6553.5 ms		If set to "0", the fastest possible time is set that is supported by the IO-Link master or the IO-Link device. • Fastest possible cycle time IO-Link master: 2 ms
0x24A1:047	IO-Link port 1: Error response		Selection of the response when an error occurs at the IO-Link port or IO-Link device. Associated error code: • 33217 | 0x81C1 - IO-Link port 1 error
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x24A1:048	IO-Link port 1: Warning response		Selection of the response when a warning occurs at the IO-Link port or IO-Link device. Associated error code: • 33221 | 0x81C5 - IO-Link port 1 warning
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	



Address	Name / setting range / [default setting]		Information
0x24A2:011	IO-Link port 2: Vendor ID 0 ... **[0]** ... 65535		
0x24A2:012	IO-Link port 2: Device ID 0 ... **[0]** ... 16777215		
0x24A2:013	IO-Link port 2: Validation method		
	0	**No check**	
	1	Type compatible	
0x24A2:014	IO-Link port 2: Backup method		
	0	**No data storage**	
	1	Backup and restore	
	2	Restore	
0x24A2:015	IO-Link port 2: Revision ID		
	0	No check	
	16	Revision V1.0	
	17	Revision V1.1	
0x24A2:016	IO-Link port 2: Cycle time 0.0 ... **[0.0]** ... 6553.5 ms		If set to "0", the fastest possible time is set that is supported by the IO-Link master or the IO-Link device. • Fastest possible cycle time IO-Link master: 2 ms
0x24A2:047	IO-Link port 2: Error response		Selection of the response when an error occurs at the IO-Link port or IO-Link device. Associated error code: • 33218 | 0x81C2 - IO-Link port 2 error
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x24A2:048	IO-Link port 2: Warning response		Selection of the response when a warning occurs at the IO-Link port or IO-Link device. Associated error code: • 33222 | 0x81C6 - IO-Link port 2 warning
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x24A3:011	IO-Link port 3: Vendor ID 0 ... **[0]** ... 65535		
0x24A3:012	IO-Link port 3: Device ID 0 ... **[0]** ... 16777215		
0x24A3:013	IO-Link port 3: Validation method		
	0	**No check**	
	1	Type compatible	
0x24A3:014	IO-Link port 3: Backup method		
	0	**No data storage**	
	1	Backup and restore	
	2	Restore	
0x24A3:015	IO-Link port 3: Revision ID		
	0	No check	
	16	Revision V1.0	
	17	Revision V1.1	
0x24A3:016	IO-Link port 3: Cycle time 0.0 ... **[0.0]** ... 6553.5 ms		If set to "0", the fastest possible time is set that is supported by the IO-Link master or the IO-Link device. • Fastest possible cycle time IO-Link master: 2 ms

Address	Name / setting range / [default setting]		Information
0x24A3:047	IO-Link port 3: Error response		Selection of the response when an error occurs at the IO-Link port or IO-Link device. Associated error code: • 33219 | 0x81C3 - IO-Link port 3 error
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x24A3:048	IO-Link port 3: Warning response		Selection of the response when a warning occurs at the IO-Link port or IO-Link device. Associated error code: • 33223 | 0x81C7 - IO-Link port 3 warning
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x24A4:011	IO-Link port 4: Vendor ID 0 ... **[0]** ... 65535		
0x24A4:012	IO-Link port 4: Device ID 0 ... **[0]** ... 16777215		
0x24A4:013	IO-Link port 4: Validation method		
	0	**No check**	
	1	Type compatible	
0x24A4:014	IO-Link port 4: Backup method		
	0	**No data storage**	
	1	Backup and restore	
	2	Restore	
0x24A4:015	IO-Link port 4: Revision ID		
	0	No check	
	16	Revision V1.0	
	17	Revision V1.1	
0x24A4:016	IO-Link port 4: Cycle time 0.0 ... **[0.0]** ... 6553.5 ms		If set to "0", the fastest possible time is set that is supported by the IO-Link master or the IO-Link device. • Fastest possible cycle time IO-Link master: 2 ms
0x24A4:047	IO-Link port 4: Error response		Selection of the response when an error occurs at the IO-Link port or IO-Link device. Associated error code: • 33220 | 0x81C4 - IO-Link port 4 error
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x24A4:048	IO-Link port 4: Warning response		Selection of the response when a warning occurs at the IO-Link port or IO-Link device. Associated error code: • 33224 | 0x81C8 - IO-Link port 4 warning
	0	**No response**	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	



11.6.2 Data mapping

Data mapping is used to define which cyclic data available from the connected IO-Link device is to be used in the inverter. When configuring the inverter with the "EASY Starter", the user assigns the available data to internal objects (parameters) of the inverter and sets the desired functionality.

Details

A connected IO-Link device provides a cyclic input and/or output process data interface. The process data received via the IO-Link ports can be linked directly to functions of the inverter. Likewise, information from the inverter can be linked to the process data sent via the IO-Link ports. In the further description this is called "mapping".

The data within the process data objects can be of different lengths. For the mapping of IO-Link process data, any length from 1 ... 32 bits is supported. On the IO-Link side the length is exactly as selected, in the inverter it is mapped to a parameter of length 8, 16 or 32 bits. Unused bits are padded with 0 (if destination > source) or ignored (if destination < source). The value is always aligned to the least significant bit.

For each input and output of each IO-Link port, an array object (0x24Dx) is available to define the mapping. Each subindex > 0 indicates the mapping for a value exchanged between inverter and IO-Link process data. The mapping information contains the parameter to be mapped (index and subindex) and the size used in the process data. The process data is referenced consecutively with each subindex in ascending order.

Change mapping

To change a mapping, the subindex 0 must be set to "0".

To reactivate the changed mapping, the number of mapping entries must be written to subindex 0.

Structure of the mapping entries

The content of the subindex in the array object is a 32-bit value with the following structure:

Byte 3 (MSB)	Byte 2	Byte 1	Byte 0 (LSB)
Index of the parameter (MSB)	Index of the parameter (LSB)	Subindex of the parameter	Data length in bits

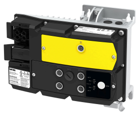
"Stuffing” entries

If the process data contains gaps (unneeded data) between the signals, these can be marked as not used with so-called "stuffing" entries.

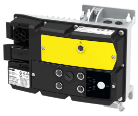
A "stuffing" entry is an entry with index 0x0005 and subindex 0x00 and an arbitrary data length of 1 ... 255 bits:

Byte 3 (MSB)	Byte 2	Byte 1	Byte 0 (LSB)
0x00	0x05	0x00	0x01 ... 0xFF

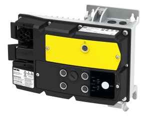
Address	Name	Default setting
0x24D0:000	IOL1-RPDO mapping: Highest subindex	0
0x24D0:001	IOL1-RPDO mapping: Entry 1	0x00000000
0x24D0:002	IOL1-RPDO mapping: Entry 2	0x00000000
0x24D0:003	IOL1-RPDO mapping: Entry 3	0x00000000
0x24D0:004	IOL1-RPDO mapping: Entry 4	0x00000000
0x24D0:005	IOL1-RPDO mapping: Entry 5	0x00000000
0x24D0:006	IOL1-RPDO mapping: Entry 6	0x00000000
0x24D0:007	IOL1-RPDO mapping: Entry 7	0x00000000
0x24D0:008	IOL1-RPDO mapping: Entry 8	0x00000000
0x24D0:009	IOL1-RPDO mapping: Entry 9	0x00000000
0x24D0:010	IOL1-RPDO mapping: Entry 10	0x00000000
0x24D0:011	IOL1-RPDO mapping: Entry 11	0x00000000
0x24D0:012	IOL1-RPDO mapping: Entry 12	0x00000000
0x24D0:013	IOL1-RPDO mapping: Entry 13	0x00000000
0x24D0:014	IOL1-RPDO mapping: Entry 14	0x00000000
0x24D0:015	IOL1-RPDO mapping: Entry 15	0x00000000
0x24D0:016	IOL1-RPDO mapping: Entry 16	0x00000000
0x24D1:000	IOL1-TPDO mapping: Highest subindex	0
0x24D1:001	IOL1-TPDO mapping: Entry 1	0x00000000
0x24D1:002	IOL1-TPDO mapping: Entry 2	0x00000000
0x24D1:003	IOL1-TPDO mapping: Entry 3	0x00000000
0x24D1:004	IOL1-TPDO mapping: Entry 4	0x00000000
0x24D1:005	IOL1-TPDO mapping: Entry 5	0x00000000
0x24D1:006	IOL1-TPDO mapping: Entry 6	0x00000000
0x24D1:007	IOL1-TPDO mapping: Entry 7	0x00000000
0x24D1:008	IOL1-TPDO mapping: Entry 8	0x00000000
0x24D1:009	IOL1-TPDO mapping: Entry 9	0x00000000
0x24D1:010	IOL1-TPDO mapping: Entry 10	0x00000000
0x24D1:011	IOL1-TPDO mapping: Entry 11	0x00000000
0x24D1:012	IOL1-TPDO mapping: Entry 12	0x00000000
0x24D1:013	IOL1-TPDO mapping: Entry 13	0x00000000
0x24D1:014	IOL1-TPDO mapping: Entry 14	0x00000000
0x24D1:015	IOL1-TPDO mapping: Entry 15	0x00000000
0x24D1:016	IOL1-TPDO mapping: Entry 16	0x00000000
0x24D2:000	IOL2-RPDO mapping: Highest subindex	0
0x24D2:001	IOL2-RPDO mapping: Entry 1	0x00000000
0x24D2:002	IOL2-RPDO mapping: Entry 2	0x00000000
0x24D2:003	IOL2-RPDO mapping: Entry 3	0x00000000
0x24D2:004	IOL2-RPDO mapping: Entry 4	0x00000000
0x24D2:005	IOL2-RPDO mapping: Entry 5	0x00000000
0x24D2:006	IOL2-RPDO mapping: Entry 6	0x00000000
0x24D2:007	IOL2-RPDO mapping: Entry 7	0x00000000
0x24D2:008	IOL2-RPDO mapping: Entry 8	0x00000000
0x24D2:009	IOL2-RPDO mapping: Entry 9	0x00000000
0x24D2:010	IOL2-RPDO mapping: Entry 10	0x00000000
0x24D2:011	IOL2-RPDO mapping: Entry 11	0x00000000
0x24D2:012	IOL2-RPDO mapping: Entry 12	0x00000000
0x24D2:013	IOL2-RPDO mapping: Entry 13	0x00000000
0x24D2:014	IOL2-RPDO mapping: Entry 14	0x00000000
0x24D2:015	IOL2-RPDO mapping: Entry 15	0x00000000
0x24D2:016	IOL2-RPDO mapping: Entry 16	0x00000000
0x24D3:000	IOL2-TPDO mapping: Highest subindex	0
0x24D3:001	IOL2-TPDO mapping: Entry 1	0x00000000
0x24D3:002	IOL2-TPDO mapping: Entry 2	0x00000000
0x24D3:003	IOL2-TPDO mapping: Entry 3	0x00000000



Address	Name	Default setting
0x24D3:004	IOL2-TPDO mapping: Entry 4	0x00000000
0x24D3:005	IOL2-TPDO mapping: Entry 5	0x00000000
0x24D3:006	IOL2-TPDO mapping: Entry 6	0x00000000
0x24D3:007	IOL2-TPDO mapping: Entry 7	0x00000000
0x24D3:008	IOL2-TPDO mapping: Entry 8	0x00000000
0x24D3:009	IOL2-TPDO mapping: Entry 9	0x00000000
0x24D3:010	IOL2-TPDO mapping: Entry 10	0x00000000
0x24D3:011	IOL2-TPDO mapping: Entry 11	0x00000000
0x24D3:012	IOL2-TPDO mapping: Entry 12	0x00000000
0x24D3:013	IOL2-TPDO mapping: Entry 13	0x00000000
0x24D3:014	IOL2-TPDO mapping: Entry 14	0x00000000
0x24D3:015	IOL2-TPDO mapping: Entry 15	0x00000000
0x24D3:016	IOL2-TPDO mapping: Entry 16	0x00000000
0x24D4:000	IOL3-RPDO mapping: Highest subindex	0
0x24D4:001	IOL3-RPDO mapping: Entry 1	0x00000000
0x24D4:002	IOL3-RPDO mapping: Entry 2	0x00000000
0x24D4:003	IOL3-RPDO mapping: Entry 3	0x00000000
0x24D4:004	IOL3-RPDO mapping: Entry 4	0x00000000
0x24D4:005	IOL3-RPDO mapping: Entry 5	0x00000000
0x24D4:006	IOL3-RPDO mapping: Entry 6	0x00000000
0x24D4:007	IOL3-RPDO mapping: Entry 7	0x00000000
0x24D4:008	IOL3-RPDO mapping: Entry 8	0x00000000
0x24D4:009	IOL3-RPDO mapping: Entry 9	0x00000000
0x24D4:010	IOL3-RPDO mapping: Entry 10	0x00000000
0x24D4:011	IOL3-RPDO mapping: Entry 11	0x00000000
0x24D4:012	IOL3-RPDO mapping: Entry 12	0x00000000
0x24D4:013	IOL3-RPDO mapping: Entry 13	0x00000000
0x24D4:014	IOL3-RPDO mapping: Entry 14	0x00000000
0x24D4:015	IOL3-RPDO mapping: Entry 15	0x00000000
0x24D4:016	IOL3-RPDO mapping: Entry 16	0x00000000
0x24D5:000	IOL3-TPDO mapping: Highest subindex	0
0x24D5:001	IOL3-TPDO mapping: Entry 1	0x00000000
0x24D5:002	IOL3-TPDO mapping: Entry 2	0x00000000
0x24D5:003	IOL3-TPDO mapping: Entry 3	0x00000000
0x24D5:004	IOL3-TPDO mapping: Entry 4	0x00000000
0x24D5:005	IOL3-TPDO mapping: Entry 5	0x00000000
0x24D5:006	IOL3-TPDO mapping: Entry 6	0x00000000
0x24D5:007	IOL3-TPDO mapping: Entry 7	0x00000000
0x24D5:008	IOL3-TPDO mapping: Entry 8	0x00000000
0x24D5:009	IOL3-TPDO mapping: Entry 9	0x00000000
0x24D5:010	IOL3-TPDO mapping: Entry 10	0x00000000
0x24D5:011	IOL3-TPDO mapping: Entry 11	0x00000000
0x24D5:012	IOL3-TPDO mapping: Entry 12	0x00000000
0x24D5:013	IOL3-TPDO mapping: Entry 13	0x00000000
0x24D5:014	IOL3-TPDO mapping: Entry 14	0x00000000
0x24D5:015	IOL3-TPDO mapping: Entry 15	0x00000000
0x24D5:016	IOL3-TPDO mapping: Entry 16	0x00000000
0x24D6:000	IOL4-RPDO mapping: Highest subindex	0
0x24D6:001	IOL4-RPDO mapping: Entry 1	0x00000000
0x24D6:002	IOL4-RPDO mapping: Entry 2	0x00000000
0x24D6:003	IOL4-RPDO mapping: Entry 3	0x00000000
0x24D6:004	IOL4-RPDO mapping: Entry 4	0x00000000
0x24D6:005	IOL4-RPDO mapping: Entry 5	0x00000000
0x24D6:006	IOL4-RPDO mapping: Entry 6	0x00000000
0x24D6:007	IOL4-RPDO mapping: Entry 7	0x00000000



Address	Name	Default setting
0x24D6:008	IOL4-RPDO mapping: Entry 8	0x00000000
0x24D6:009	IOL4-RPDO mapping: Entry 9	0x00000000
0x24D6:010	IOL4-RPDO mapping: Entry 10	0x00000000
0x24D6:011	IOL4-RPDO mapping: Entry 11	0x00000000
0x24D6:012	IOL4-RPDO mapping: Entry 12	0x00000000
0x24D6:013	IOL4-RPDO mapping: Entry 13	0x00000000
0x24D6:014	IOL4-RPDO mapping: Entry 14	0x00000000
0x24D6:015	IOL4-RPDO mapping: Entry 15	0x00000000
0x24D6:016	IOL4-RPDO mapping: Entry 16	0x00000000
0x24D7:000	IOL4-TPDO mapping: Highest subindex	0
0x24D7:001	IOL4-TPDO mapping: Entry 1	0x00000000
0x24D7:002	IOL4-TPDO mapping: Entry 2	0x00000000
0x24D7:003	IOL4-TPDO mapping: Entry 3	0x00000000
0x24D7:004	IOL4-TPDO mapping: Entry 4	0x00000000
0x24D7:005	IOL4-TPDO mapping: Entry 5	0x00000000
0x24D7:006	IOL4-TPDO mapping: Entry 6	0x00000000
0x24D7:007	IOL4-TPDO mapping: Entry 7	0x00000000
0x24D7:008	IOL4-TPDO mapping: Entry 8	0x00000000
0x24D7:009	IOL4-TPDO mapping: Entry 9	0x00000000
0x24D7:010	IOL4-TPDO mapping: Entry 10	0x00000000
0x24D7:011	IOL4-TPDO mapping: Entry 11	0x00000000
0x24D7:012	IOL4-TPDO mapping: Entry 12	0x00000000
0x24D7:013	IOL4-TPDO mapping: Entry 13	0x00000000
0x24D7:014	IOL4-TPDO mapping: Entry 14	0x00000000
0x24D7:015	IOL4-TPDO mapping: Entry 15	0x00000000
0x24D7:016	IOL4-TPDO mapping: Entry 16	0x00000000



11.6.3 Binary input configuration

Selection and configuration of binary values received via IO-Link for use within the inverter.

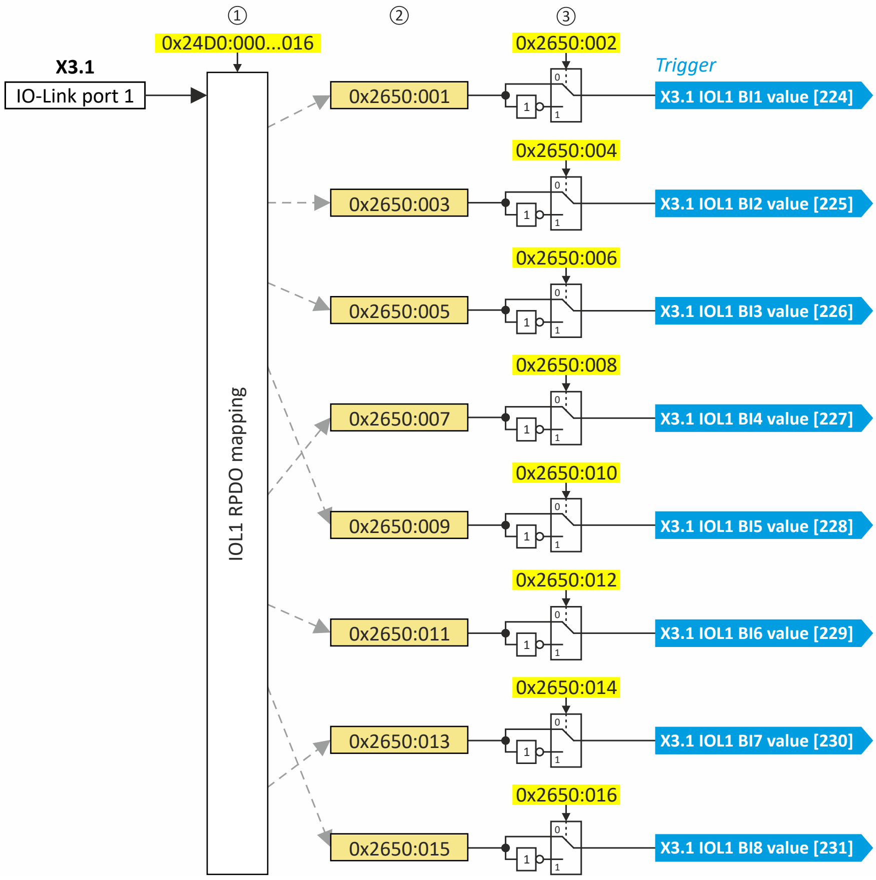
Details

Individual bits of the IO-Link process input data can be mapped to internal variables, so-called "binary inputs". The binary inputs can be used for control tasks. For this purpose, the binary inputs are available as selectable triggers for functions.

- 8 binary inputs are available for each IO-Link port.
- For each binary input, there is a parameter object that can be assigned to the corresponding IO-Link process input data via the data mapping.
  Note: Each port has its own input signals. It is not allowed to enter a signal from another port in the process data mapping.
- Each individual binary input can be configured so that its state is logically inverted internally.

11.6.3.1 IO-Link port 1

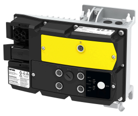
Binary input configuration for IO-Link port 1:



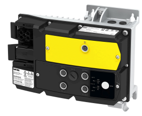
① Data mapping 📖 208 ② Mappable objects ③ Inversion (optional)

Parameter

Address	Name / setting range / [default setting]		Information
0x2650:001	Binary input configuration: X3.1 IOL1 BI1 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500101
0x2650:002	Binary input configuration: X3.1 IOL1 BI1 inversion		
	0	**Not inverted**	
	1	Inverted	

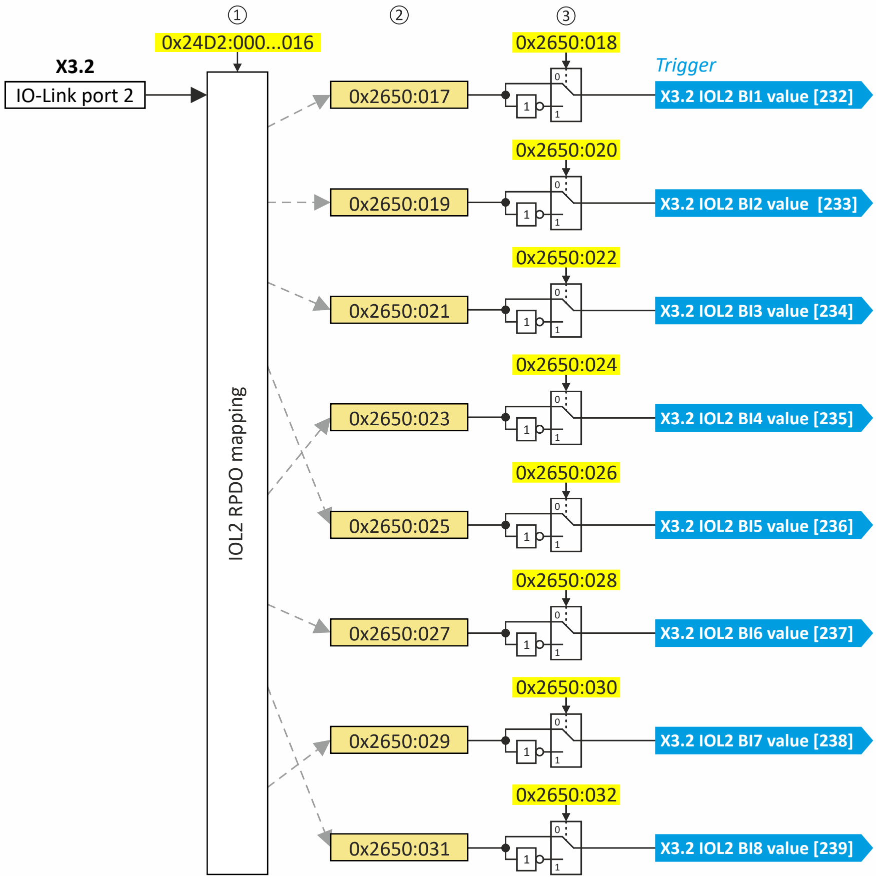


Address	Name / setting range / [default setting]	Information
0x2650:003	Binary input configuration: X3.1 IOL1 BI2 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500301
0x2650:004	Binary input configuration: X3.1 IOL1 BI2 inverted **0** **Not inverted** 1 Inverted	
0x2650:005	Binary input configuration: X3.1 IOL1 BI3 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500501
0x2650:006	Binary input configuration: X3.1 IOL1 BI3 inverted **0** **Not inverted** 1 Inverted	
0x2650:007	Binary input configuration: X3.1 IOL1 BI4 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500701
0x2650:008	Binary input configuration: X3.1 IOL1 BI4 inverted **0** **Not inverted** 1 Inverted	
0x2650:009	Binary input configuration: X3.1 IOL1 BI5 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500901
0x2650:010	Binary input configuration: X3.1 IOL1 BI5 inverted **0** **Not inverted** 1 Inverted	
0x2650:011	Binary input configuration: X3.1 IOL1 BI6 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500B01
0x2650:012	Binary input configuration: X3.1 IOL1 BI6 inversion **0** **Not inverted** 1 Inverted	
0x2650:013	Binary input configuration: X3.1 IOL1 BI7 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500D01
0x2650:014	Binary input configuration: X3.1 IOL1 BI7 inversion **0** **Not inverted** 1 Inverted	
0x2650:015	Binary input configuration: X3.1 IOL1 BI8 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x26500F01
0x2650:016	Binary input configuration: X3.1 IOL1 BI8 inversion **0** **Not inverted** 1 Inverted	



11.6.3.2 IO-Link port 2

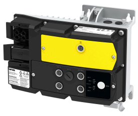
Binary input configuration for IO-Link port 2:



① Data mapping 📖 208   ② Mappable objects   ③ Inversion (optional)

Parameter

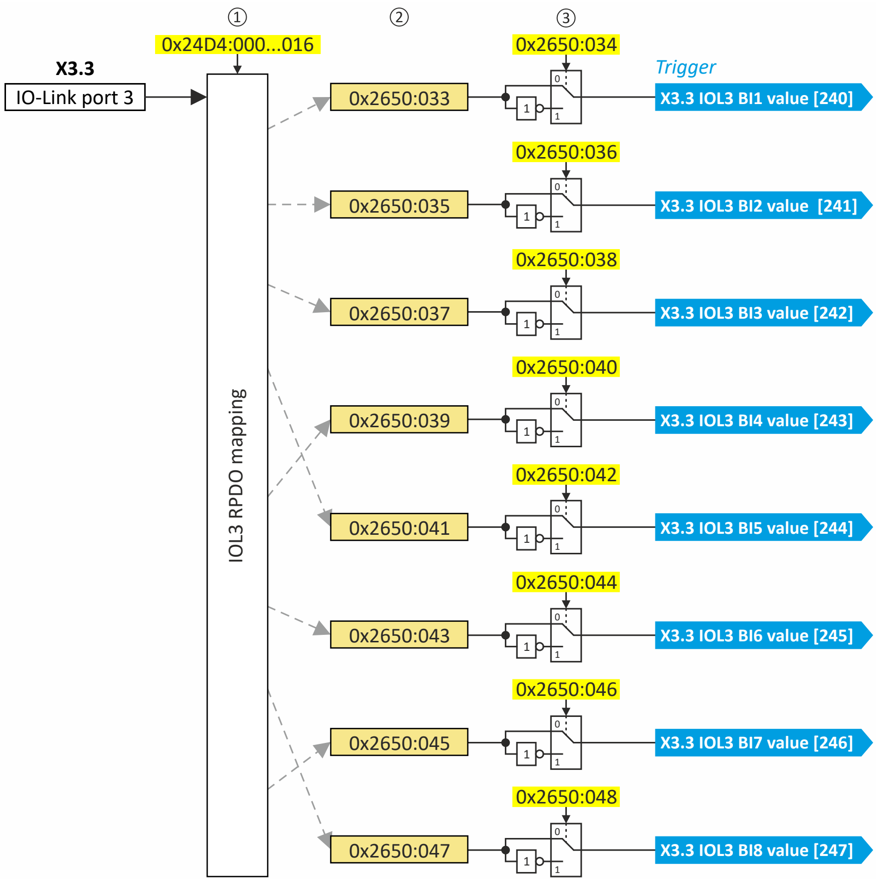
Address	Name / setting range / [default setting]		Information
0x2650:017	Binary input configuration: X3.2 IOL2 BI1 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:018	Binary input configuration: X3.2 IOL2 BI1 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:019	Binary input configuration: X3.2 IOL2 BI2 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:020	Binary input configuration: X3.2 IOL2 BI2 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:021	Binary input configuration: X3.2 IOL2 BI3 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:022	Binary input configuration: X3.2 IOL2 BI3 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:023	Binary input configuration: X3.2 IOL2 BI4 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:024	Binary input configuration: X3.2 IOL2 BI4 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:025	Binary input configuration: X3.2 IOL2 BI5 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).



Address	Name / setting range / [default setting]	Information
0x2650:026	Binary input configuration: X3.2 IOL2 BI5 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2650:027	Binary input configuration: X3.2 IOL2 BI6 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:028	Binary input configuration: X3.2 IOL2 BI6 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2650:029	Binary input configuration: X3.2 IOL2 BI7 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:030	Binary input configuration: X3.2 IOL2 BI7 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2650:031	Binary input configuration: X3.2 IOL2 BI8 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016).
0x2650:032	Binary input configuration: X3.2 IOL2 BI8 inversion	
	0 **Not inverted**	
	1 Inverted	

11.6.3.3 IO-Link port 3

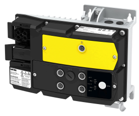
Binary input configuration for IO-Link port 3:



① Data mapping 📖 208 ② Mappable objects ③ Inversion (optional)

Parameter

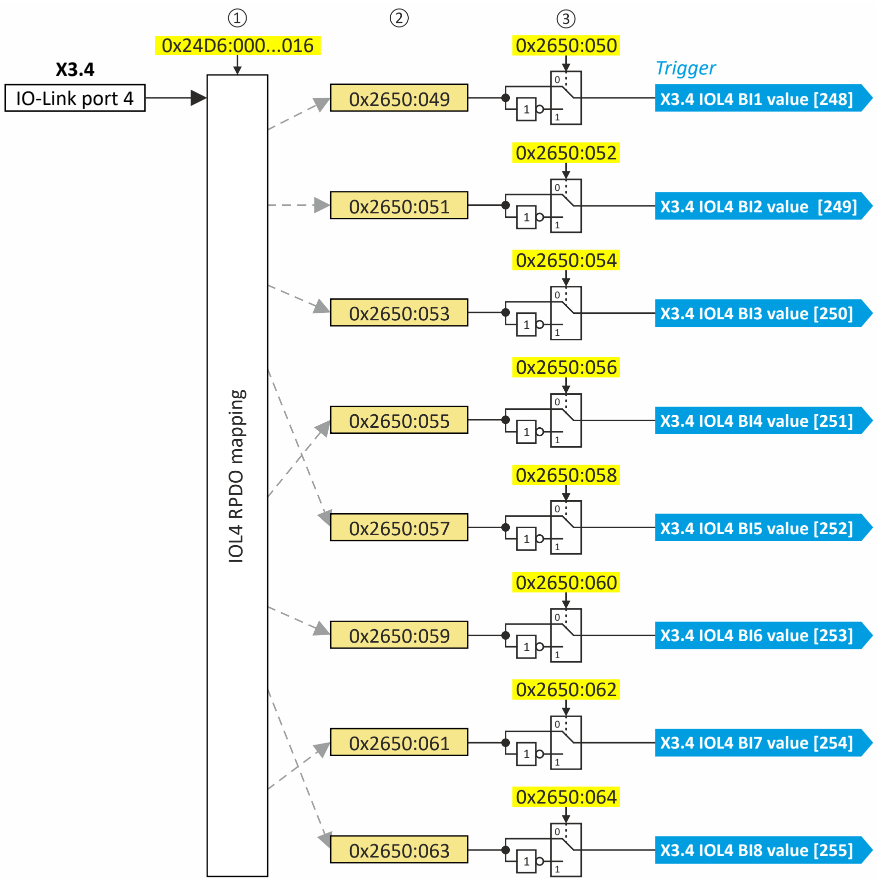
Address	Name / setting range / [default setting]	Information
0x2650:033	Binary input configuration: X3.3 IOL3 BI1 value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).



Address	Name / setting range / [default setting]		Information
0x2650:034	Binary input configuration: X3.3 IOL3 BI1 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:035	Binary input configuration: X3.3 IOL3 BI2 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:036	Binary input configuration: X3.3 IOL3 BI2 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:037	Binary input configuration: X3.3 IOL3 BI3 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:038	Binary input configuration: X3.3 IOL3 BI3 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:039	Binary input configuration: X3.3 IOL3 BI4 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:040	Binary input configuration: X3.3 IOL3 BI4 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:041	Binary input configuration: X3.3 IOL3 BI5 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:042	Binary input configuration: X3.3 IOL3 BI5 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:043	Binary input configuration: X3.3 IOL3 BI6 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:044	Binary input configuration: X3.3 IOL3 BI6 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:045	Binary input configuration: X3.3 IOL3 BI7 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:046	Binary input configuration: X3.3 IOL3 BI7 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:047	Binary input configuration: X3.3 IOL3 BI8 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016).
0x2650:048	Binary input configuration: X3.3 IOL3 BI8 inversion		
	0	**Not inverted**	
	1	Inverted	

11.6.3.4 IO-Link port 4

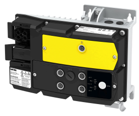
Binary input configuration for IO-Link port 4:



① Data mapping 208 ② Mappable objects ③ Inversion (optional)

Parameter

Address	Name / setting range / [default setting]		Information
0x2650:049	Binary input configuration: X3.4 IOL4 BI1 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:050	Binary input configuration: X3.4 IOL4 BI1 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:051	Binary input configuration: X3.4 IOL4 BI2 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:052	Binary input configuration: X3.4 IOL4 BI2 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:053	Binary input configuration: X3.4 IOL4 BI3 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:054	Binary input configuration: X3.4 IOL4 BI3 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:055	Binary input configuration: X3.4 IOL4 BI4 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:056	Binary input configuration: X3.4 IOL4 BI4 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:057	Binary input configuration: X3.4 IOL4 BI5 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).



Address	Name / setting range / [default setting]		Information
0x2650:058	Binary input configuration: X3.4 IOL4 BI5 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:059	Binary input configuration: X3.4 IOL4 BI6 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:060	Binary input configuration: X3.4 IOL4 BI6 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:061	Binary input configuration: X3.4 IOL4 BI7 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:062	Binary input configuration: X3.4 IOL4 BI7 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2650:063	Binary input configuration: X3.4 IOL4 BI8 value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016).
0x2650:064	Binary input configuration: X3.4 IOL4 BI8 inversion		
	0	**Not inverted**	
	1	Inverted	

11.6.4 Binary output configuration

Selection and configuration of the inverter's internal binary values for output via IO-Link.

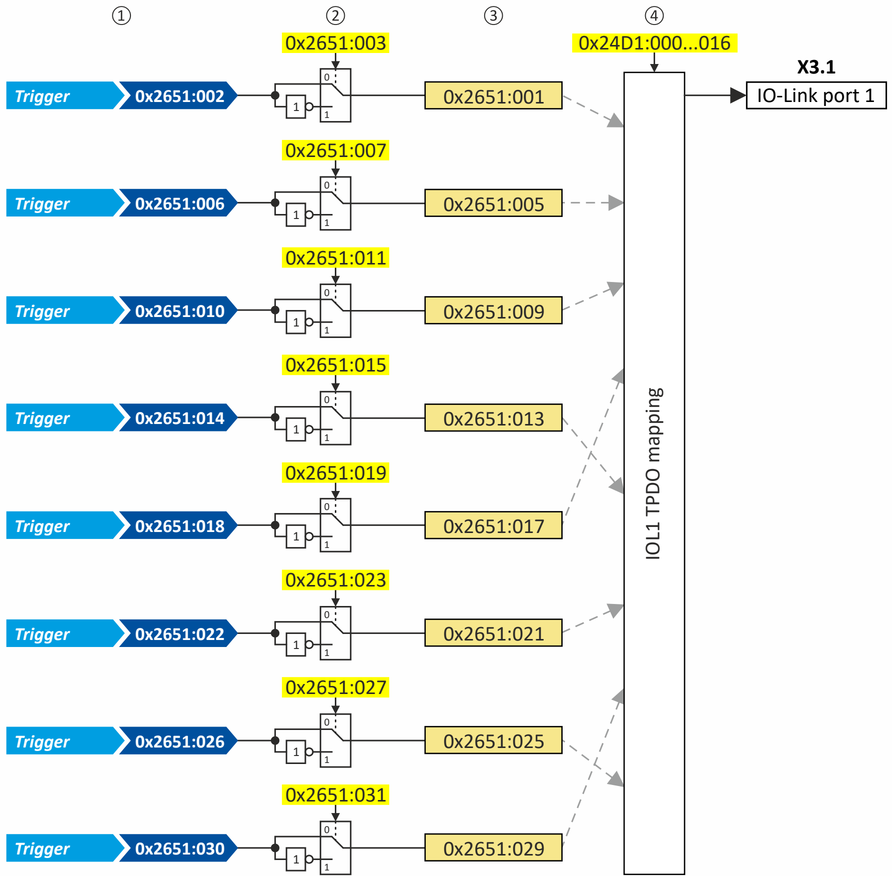
Details

Individual bits of the IO-Link process output data can be mapped to internal variables, so-called "binary outputs". An internal status signal of the inverter can be assigned to each binary output.

- 8 binary outputs are available for each IO-Link port.
- For each binary output there is a parameter object that can be assigned to the corresponding IO-Link process output data via the data mapping.
  Note: Each port has its own output signals. It is not allowed to enter a signal from another port in the process data mapping.
- Each individual binary output can be configured so that its state is logically inverted internally.

11.6.4.1 IO-Link port 1

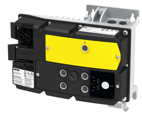
Binary output configuration for IO-Link port 1:



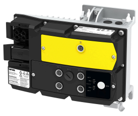
① Selection of the status signals ② Inversion (optional) ③ Mappable objects ④ Data mapping 208

Parameter

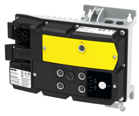
Address	Name / setting range / [default setting]	Information
0x2651:001	Binary output configuration: X3.1 IOL1 BO1 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26510101
0x2651:002	Binary output configuration: X3.1 IOL1 BO1 source	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
	1 Constant TRUE	Trigger is constantly TRUE.
	11 Digital input 1	State of X3/DI1, taking an inversion set in 0x2632:001 into consideration.



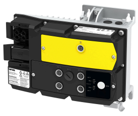
Address	Name / setting range / [default setting]		Information
	12	Digital input 2	State of X3/DI2, taking an inversion set in 0x2632:002 into consideration.
	13	Digital input 3	State of X3/DI3, taking an inversion set in 0x2632:003 into consideration.
	14	Digital input 4	State of X3/DI4, taking an inversion set in 0x2632:004 into consideration.
	15	Digital input 5	State of X3/DI5, taking an inversion set in 0x2632:005 into consideration.
	16	Digital input 6	State of X3/DI6, taking an inversion set in 0x2632:006 into consideration.
	17	Digital input 7	State of X3/DI7, taking an inversion set in 0x2632:007 into consideration.
	30	NetWordIN1 - bit 12	State of NetWordIN1/bit 12 ... 15. • Display of NetWordIN1 in 0x4008:001. • For implementing an individual control word format, NetWordIN1 can be mapped to a process data input word.
	31	NetWordIN1 - bit 13	
	32	NetWordIN1 - bit 14	
	33	NetWordIN1 - bit 15	
	34	NetWordIN2 - bit 0	State of NetWordIN2/bit 0 ... bit 15. • Display of NetWordIN2 in 0x4008:002. • For controlling the digital outputs via network, NetWordIN2 can be mapped to a process data input word.
	35	NetWordIN2 - bit 1	
	36	NetWordIN2 - bit 2	
	37	NetWordIN2 - bit 3	
	38	NetWordIN2 - bit 4	
	39	NetWordIN2 - bit 5	
	40	NetWordIN2 - bit 6	
	41	NetWordIN2 - bit 7	
	42	NetWordIN2 - bit 8	
	43	NetWordIN2 - bit 9	
	44	NetWordIN2 - bit 10	
	45	NetWordIN2 - bit 11	
	46	NetWordIN2 - bit 12	
	47	NetWordIN2 - bit 13	
	48	NetWordIN2 - bit 14	
	49	NetWordIN2 - bit 15	
	50	Running	TRUE if inverter and start are enabled and output frequency > 0 Hz. Otherwise FALSE. Exception, quick stop mode: TRUE if inverter and start are enabled and output frequency > 0.2 Hz. Otherwise FALSE.
	51	Ready for operation	TRUE if inverter is ready for operation (no error active, no STO active and DC-bus voltage ok). Otherwise FALSE.
	52	Operation enabled	TRUE if inverter and start are enabled. Otherwise FALSE.
	53	Stop active	TRUE if inverter is enabled and motor is not started and output frequency = 0.
	54	Quick stop active	TRUE if quick stop is active. Otherwise FALSE.
	55	Inverter disabled (safety)	TRUE if the integrated safety system has inhibited the inverter. Otherwise FALSE. ▶ Safe torque off (STO) 📖 427
	56	Fault active	TRUE if error is active. Otherwise FALSE.
	57	Error (non-resettable) active	TRUE if non-resettable error is active. Otherwise FALSE.
	58	Device warning active	TRUE if warning is active. Otherwise FALSE. • A warning has no impact on the operating status of the inverter. • A warning is reset automatically if the cause has been eliminated.
	59	Device trouble active	TRUE if a fault is active. Otherwise FALSE. • In the event of a fault, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. • Exception: In case of a serious fault, the inverter is disabled immediately. The motor has no torque (coasts). • The error state will be left automatically if the error condition is not active anymore. • The restart behaviour after trouble can be configured. ▶ Automatic restart after a fault 📖 399
	60	Heatsink temperature warning active	TRUE if current heatsink temperature > warning threshold for temperature monitoring. Otherwise FALSE. • Display of the current heatsink temperature in 0x2D84:001. • Setting of the warning threshold in 0x2D84:002.



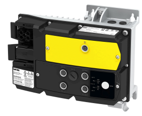
Address	Name / setting range / [default setting]		Information
	65	Motor PTC error active	TRUE if an error of the motor PTC has been detected. Otherwise FALSE. • The trigger is set irrespective of the response set in 0x2D49:002 when the motor temperature monitoring is triggered. ▸ Motor temperature monitoring 📖 180
	66	Flying restart circuit active	TRUE if flying restart circuit active is active. Otherwise FALSE. ▸ Flying restart circuit 📖 133
	67	DC braking active	TRUE if DC braking is active. Otherwise FALSE. ▸ DC braking 📖 145
	68	Stop command active	TRUE if delay to standstill active. Otherwise FALSE.
	69	Rotational direction reversed	TRUE if output frequency is negative. Otherwise FALSE.
	70	Frequency threshold exceeded	TRUE if current output frequency > frequency threshold. Otherwise FALSE. • Display of the current output frequency in 0x2DDD. • Setting Frequency threshold in 0x4005. ▸ Trigger action if a frequency threshold is exceeded 📖 421
	71	Actual speed = 0	TRUE if actual output frequency = 0 Hz (± 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD.
	72	Setpoint speed reached	TRUE if frequency setpoint reached. Otherwise FALSE.
	73	PID feedback = setpoint	TRUE if the controlled feedback variable = process controller setpoint (± in 0x404D:003 set hysteresis). Otherwise FALSE. ▸ Configuring the process controller📖 80
	74	PID sleep mode active	TRUE if the inverter is in "PID sleep mode". Otherwise FALSE. ▸ Process controller sleep mode 📖 87
	75	PID MIN alarm active	TRUE if feedback variable (with activated PID control) < MIN alarm threshold. Otherwise FALSE. • Setting of MIN alarm threshold in 0x404D:001. ▸ Configuring the process controller 📖 80
	76	PID MAX alarm active	TRUE if the feedback variable (with activated PID control) > MAX alarm threshold. Otherwise FALSE. • Setting of MAX alarm threshold in 0x404D:002. ▸ Configuring the process controller 📖 80
	77	PID MIN-MAX alarm active	TRUE if no PID alarm is active with activated PID control (MIN alarm threshold < feedback variable < MAX alarm threshold). Otherwise FALSE. • Setting of MIN alarm threshold in 0x404D:001. • Setting of MAX alarm threshold in 0x404D:002. ▸ Configuring the process controller 📖 80
	78	Current limit reached	TRUE if current motor current ≥ maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88. • Setting for the maximum current in 0x6073.
	79	Torque limit reached	TRUE if torque limit has been reached or exceeded. Otherwise FALSE. • Setting "Actual positive torque limit" in 0x2949:003. • Setting "Actual negative torque limit" in 0x2949:004. ▸ Motor torque monitoring 📖 184
	83	Load loss detected	TRUE if actual motor current < threshold for load loss detection after delay time of the load loss detection has elapsed. Otherwise FALSE. • Display of the actual current in 0x6078. • Setting Threshold in 0x4006:001. • Setting Delay time in 0x4006:002. ▸ Load loss detection 📖 160
	84	Heavy load monitoring	TRUE if the actual apparent current of the motor exceeds the threshold for longer than the delay time. FALSE if the actual apparent current of the motor falls below the threshold value minus 5 % (hysteresis). ▸ Heavy load monitoring 📖 187
	108	Parameter set 1 active	TRUE if parameter set 1 is loaded and active. Otherwise FALSE.
	109	Parameter set 2 active	TRUE if parameter set 2 is loaded and active. Otherwise FALSE.
	110	Parameter set 3 active	TRUE if parameter set 3 is loaded and active. Otherwise FALSE.
	111	Parameter set 4 active	TRUE if parameter set 4 is loaded and active. Otherwise FALSE.



Address	Name / setting range / [default setting]		Information
	112	Parameter set load OK	TRUE after any parameter set has been loaded. Otherwise FALSE.
	113	Parameter set load fail	TRUE if any of the parameter sets could not be loaded. Otherwise FALSE.
	115	Release holding brake	Trigger signal for releasing the holding brake (TRUE = release holding brake). Note! If this trigger is assigned to the relay or a digital output, the deceleration times set for the respective output are not effective (are internally set to "0"). Only the deceleration time set in 0x2820:012 for closing the holding brake influences in this case the time-dependent behaviour of the output. ▶ Holding brake control 📖 152
	117	Motor phase failure	TRUE if a motor phase failure has been detected. Otherwise FALSE. Note! In the "SLSM-PSM" motor control mode, detection for motor phase failure is deactivated if HF injection is active in the low-speed range. ▶ Motor phase failure detection 📖 182
	119	Holding brake released	TRUE, if holding brake is released. Otherwise FALSE. ▶ Holding brake control 📖 152
	155	STO active	TRUE if the integrated safety system has triggered the "Safe torque off (STO)" function and if the safe inputs SIA and SIB = LOW (simultaneously). Otherwise FALSE. ▶ Safe torque off (STO) 📖 427
0x2651:003	Binary output configuration: X3.1 IOL1 BO1 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:005	Binary output configuration: X3.1 IOL1 BO2 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26510501
0x2651:006	Binary output configuration: X3.1 IOL1 BO2 source • For further possible settings, see parameter 0x2651:002. 📖 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:007	Binary output configuration: X3.1 IOL1 BO2 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:009	Binary output configuration: X3.1 IOL3 BO3 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26510901
0x2651:010	Binary output configuration: X3.1 IOL3 BO3 source • For further possible settings, see parameter 0x2651:002. 📖 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:011	Binary output configuration: X3.1 IOL1 BO3 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:013	Binary output configuration: X3.1 IOL1 BO4 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26510D01
0x2651:014	Binary output configuration: X3.1 IOL1 BO4 source • For further possible settings, see parameter 0x2651:002. 📖 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:015	Binary output configuration: X3.1 IOL1 BO4 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:017	Binary output configuration: X3.1 IOL1 BO5 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26511101

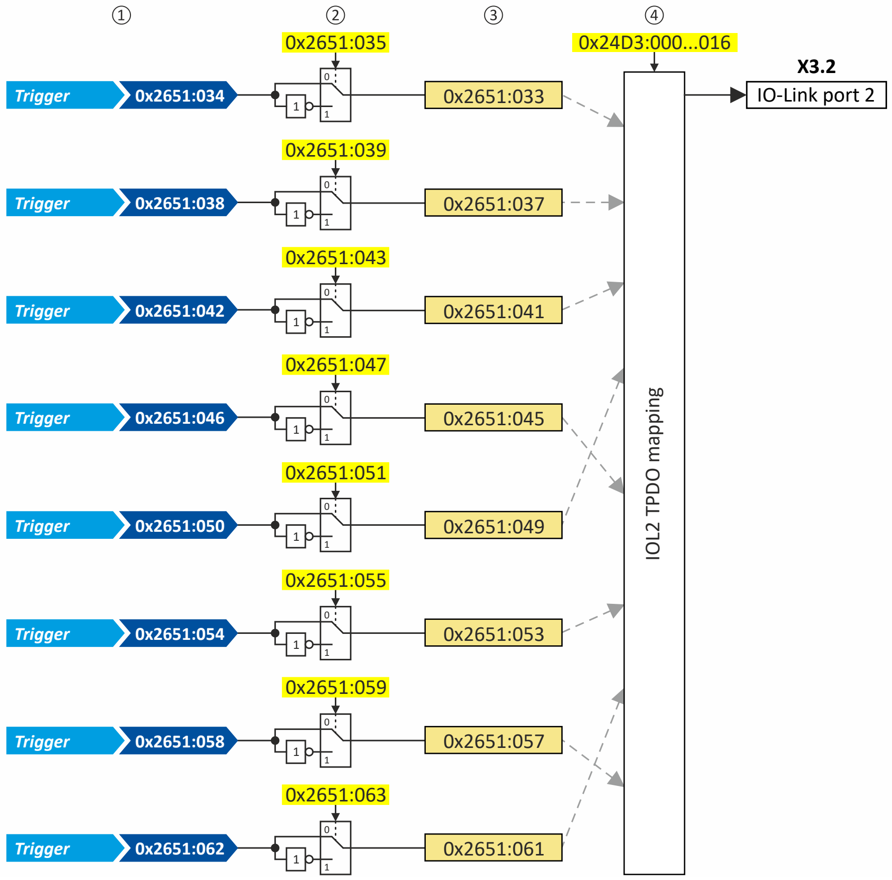


Address	Name / setting range / [default setting]	Information
0x2651:018	Binary output configuration: X3.1 IOL1 BO5 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:019	Binary output configuration: X3.1 IOL1 BO5 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:021	Binary output configuration: X3.1 IOL1 BO6 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26511501
0x2651:022	Binary output configuration: X3.1 IOL1 BO6 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:023	Binary output configuration: X3.1 IOL1 BO6 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:025	Binary output configuration: X3.1 IOL1 BO7 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26511901
0x2651:026	Binary output configuration: X3.1 IOL1 BO7 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:027	Binary output configuration: X3.1 IOL1 BIO7 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:029	Binary output configuration: X3.1 IOL1 BO8 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 1 via the IOL1-TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x26511D01
0x2651:030	Binary output configuration: X3.1 IOL1 BO8 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:031	Binary output configuration: X3.1 IOL1 BO8 inversion	
	0 **Not inverted**	
	1 Inverted	



11.6.4.2 IO-Link port 2

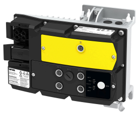
Binary output configuration for IO-Link port 2:



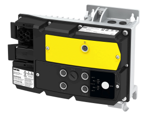
① Selection of the status signals ② Inversion (optional) ③ Mappable objects ④ Data mapping 📖 208

Parameter

Address	Name / setting range / [default setting]		Information
0x2651:033	Binary output configuration: X3.2 IOL2 BO1 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26512101
0x2651:034	Binary output configuration: X3.2 IOL2 BO1 source • For further possible settings, see parameter 0x2651:002. 📖 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:035	Binary output configuration: X3.2 IOL2 BO1 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:037	Binary output configuration: X3.2 IOL2 BO2 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26512501
0x2651:038	Binary output configuration: X3.2 IOL2 BO2 source • For further possible settings, see parameter 0x2651:002. 📖 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:039	Binary output configuration: X3.2 IOL2 BO2 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:041	Binary output configuration: X3.2 IOL2 BO3 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26512901

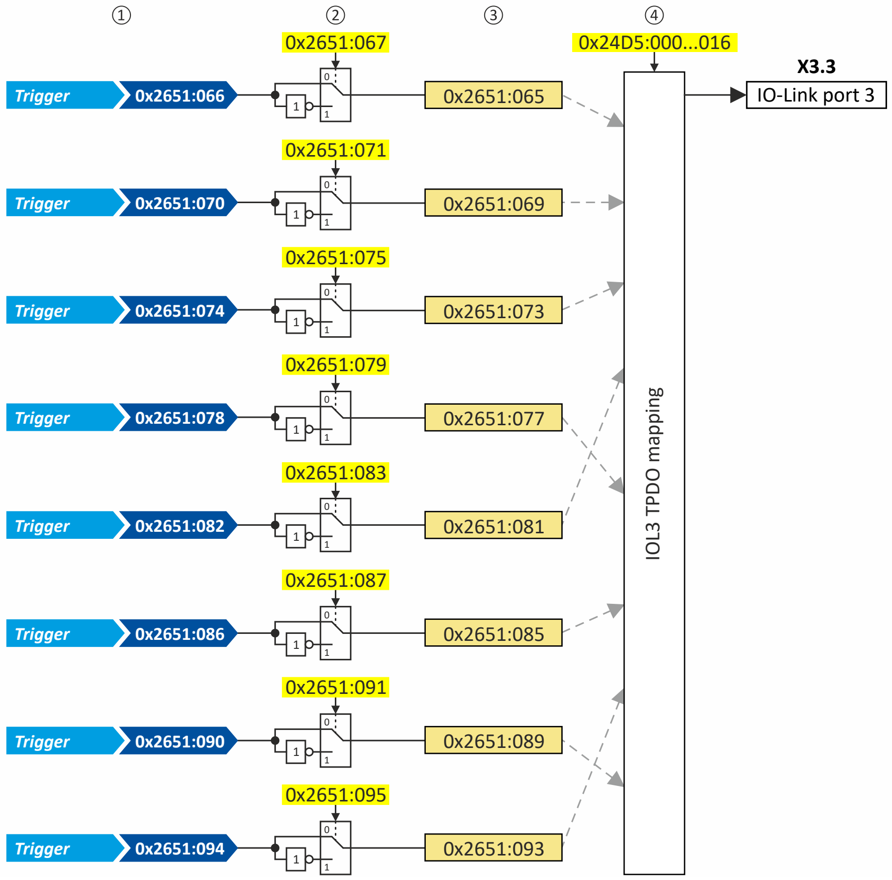


Address	Name / setting range / [default setting]	Information
0x2651:042	Binary output configuration: X3.2 IOL2 BO3 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:043	Binary output configuration: X3.2 IOL2 BO3 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:045	Binary output configuration: X3.2 IOL2 BO4 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26512D01
0x2651:046	Binary output configuration: X3.2 IOL2 BO4 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:047	Binary output configuration: X3.2 IOL2 BO4 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:049	Binary output configuration: X3.2 IOL2 BO5 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26513101
0x2651:050	Binary output configuration: X3.2 IOL2 BO5 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:051	Binary output configuration: X3.2 IOL2 BO5 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:053	Binary output configuration: X3.2 IOL2 BO6 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26513501
0x2651:054	Binary output configuration: X3.2 IOL2 BO6 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:055	Binary output configuration: X3.2 IOL2 BO6 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:057	Binary output configuration: X3.2 IOL2 BO7 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26513901
0x2651:058	Binary output configuration: X3.2 IOL2 BO7 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:059	Binary output configuration: X3.2 IOL2 BO7 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:061	Binary output configuration: X3.2 IOL2 BO8 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 2 via the IOL2-TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x26513D01
0x2651:062	Binary output configuration: X3.2 IOL2 BO8 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:063	Binary output configuration: X3.2 IOL2 BO8 inversion	
	0 **Not inverted**	
	1 Inverted	



11.6.4.3 IO-Link port 3

Binary output configuration for IO-Link port 3:

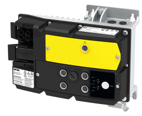


① Selection of the status signals ② Inversion (optional) ③ Mappable objects ④ Data mapping 208

Parameter

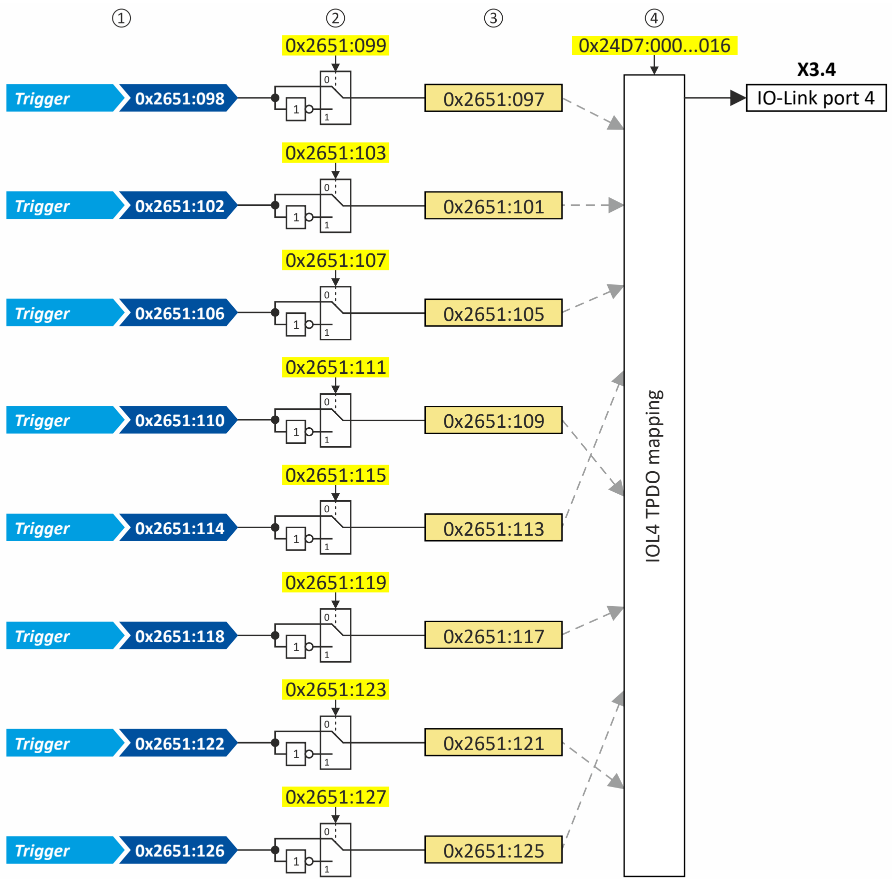
Address	Name / setting range / [default setting]		Information
0x2651:065	Binary output configuration: X3.3 IOL3 BO1 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26514101
0x2651:066	Binary output configuration: X3.3 IOL3 BO1 source • For further possible settings, see parameter 0x2651:002. 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:067	Binary output configuration: X3.3 IOL3 BO1 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:069	Binary output configuration: X3.3 IOL3 BO2 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26514501
0x2651:070	Binary output configuration: X3.3 IOL3 BO2 source • For further possible settings, see parameter 0x2651:002. 219		
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:071	Binary output configuration: X3.3 IOL3 BO2 inversion		
	0	**Not inverted**	
	1	Inverted	
0x2651:073	Binary output configuration: X3.3 IOL3 BO3 value • Read only		Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26514901

Address	Name / setting range / [default setting]	Information
0x2651:074	Binary output configuration: X3.3 IOL3 BO3 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:075	Binary output configuration: X3.3 IOL3 BO3 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:077	Binary output configuration: X3.3 IOL3 BO4 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26514D01
0x2651:078	Binary output configuration: X3.3 IOL3 BO4 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:079	Binary output configuration: X3.3 IOL3 BO4 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:081	Binary output configuration: X3.3 IOL3 BO5 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26515101
0x2651:082	Binary output configuration: X3.3 IOL3 BO5 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:083	Binary output configuration: X3.3 IOL3 BO5 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:085	Binary output configuration: X3.3 IOL3 BO6 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26515501
0x2651:086	Binary output configuration: X3.3 IOL3 BO6 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:087	Binary output configuration: X3.3 IOL3 BO6 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:089	Binary output configuration: X3.3 IOL3 BO7 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26515901
0x2651:090	Binary output configuration: X3.3 IOL3 BO7 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:091	Binary output configuration: X3.3 IOL3 BO7 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:093	Binary output configuration: X3.3 IOL3 BO8 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 3 via the IOL3-TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26515D01
0x2651:094	Binary output configuration: X3.3 IOL3 BO8 source • For further possible settings, see parameter 0x2651:002. 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:095	Binary output configuration: X3.3 IOL3 BO8 inversion	
	0 **Not inverted**	
	1 Inverted	



11.6.4.4 IO-Link port 4

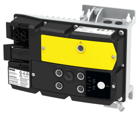
Binary output configuration for IO-Link port 4:



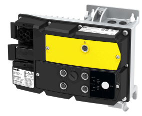
① Selection of the status signals ② Inversion (optional) ③ Mappable objects ④ Data mapping 208

Parameter

Address	Name / setting range / [default setting]	Information
0x2651:097	Binary output configuration: X3.4 IOL4 BO1 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26516101
0x2651:098	Binary output configuration: X3.4 IOL4 BO1 source • For further possible settings, see parameter 0x2651:002. 219	
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2651:099	Binary output configuration: X3.4 IOL4 BO1 inversion	
	0 Not inverted	
	1 Inverted	
0x2651:101	Binary output configuration: X3.4 IOL4 BO2 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26516501
0x2651:102	Binary output configuration: X3.4 IOL4 BO2 source • For further possible settings, see parameter 0x2651:002. 219	
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2651:103	Binary output configuration: X3.4 IOL4 BO2 inversion	
	0 Not inverted	
	1 Inverted	
0x2651:105	Binary output configuration: X3.4 IOL4 BO3 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26516901



Address	Name / setting range / [default setting]	Information
0x2651:106	Binary output configuration: X3.4 IOL4 BO3 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:107	Binary output configuration: X3.4 IOL4 BO3 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:109	Binary output configuration: X3.4 IOL4 BO4 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26516D01
0x2651:110	Binary output configuration: X3.4 IOL4 BO4 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:111	Binary output configuration: X3.4 IOL4 BO4 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:113	Binary output configuration: X3.4 IOL4 BO5 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26517101
0x2651:114	Binary output configuration: X3.4 IOL4 BO5 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:115	Binary output configuration: X3.4 IOL4 BO5 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:117	Binary output configuration: X3.4 IOL4 BO6 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26517501
0x2651:118	Binary output configuration: X3.4 IOL4 BO6 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:119	Binary output configuration: X3.4 IOL4 BO6 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:121	Binary output configuration: X3.4 IOL4 BO7 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26517901
0x2651:122	Binary output configuration: X3.4 IOL4 BO7 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:123	Binary output configuration: X3.4 IOL4 BO7 inversion	
	0 **Not inverted**	
	1 Inverted	
0x2651:125	Binary output configuration: X3.4 IOL4 BO8 value • Read only	Parameter object that can be assigned to the process output data of IO-Link port 4 via the IOL4-TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26517D01
0x2651:126	Binary output configuration: X3.4 IOL4 BO8 source • For further possible settings, see parameter 0x2651:002. 🕮 219	
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2651:127	Binary output configuration: X3.4 IOL4 BO8 inversion	
	0 **Not inverted**	
	1 Inverted	



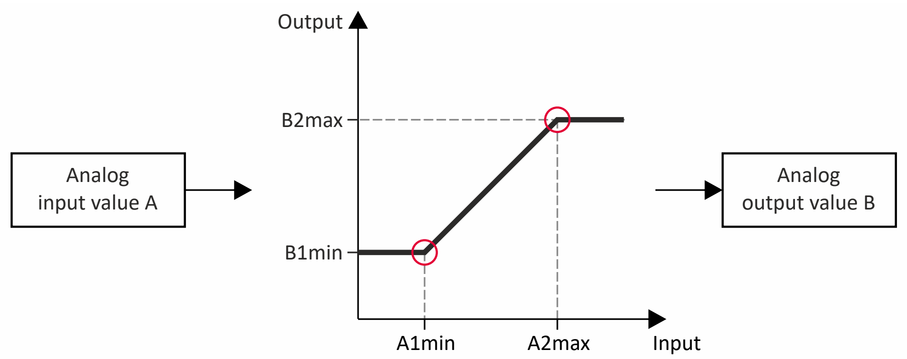
11.6.5 Analog input configuration

Selection and configuration of analog values received via IO-Link for use within the inverter.

Details

Individual analog values of the IO-Link process input data can be mapped to internal variables, so-called "analog inputs". The analog inputs can be set, for example, in 0x2860:001 as setpoint source for frequency control or in 0x2860:003 as setpoint source for torque control.

- 2 analog inputs are available for each IO-Link port.
- For each analog input, there is a parameter object that can be assigned to the corresponding IO-Link process input data via the data mapping.
  Note: Each port has its own input signals. It is not allowed to enter a signal from another port in the process data mapping.
- The analog values can have a data length of 2 ... 32 bit.
- A scaling can be parameterized for the analog values:

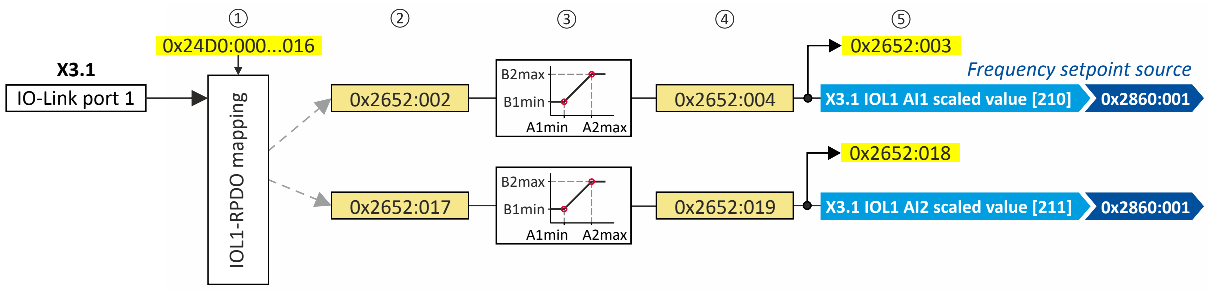


- The analog inputs are available for selection in the following parameters:

Address	Name
0x2860:001	Frequency control: Default setpoint source
0x2860:002	PID control: Default setpoint source
0x2860:003	Torque control: Default setpoint source
0x2946:003	Speed limitation: Upper speed limit source
0x2946:004	Speed limitation: Lower speed limit source
0x2949:001	Torque limit source selection: Positive torque limit source
0x2949:002	Torque limit source selection: Negative torque limit source
0x4020:002	Process controller setup (PID): PID process variable
0x4020:004	Process controller setup (PID): Speed feedforward control source

11.6.5.1 IO-Link port 1

Analog input configuration for IO-Link port 1:

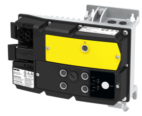


① Data mapping 📖 208
② Display of unscaled analog values
③ Scaling
④ Display of scaled analog values
⑤ Optional mapping of the scaled analog values to parameters of the inverter

The analog inputs can not only be used as frequency setpoint source, but are also available for selection in other parameters.

Parameter

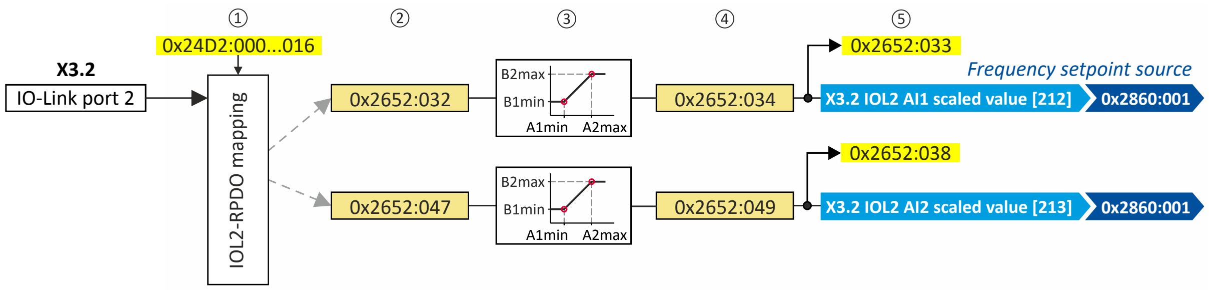
Address	Name / setting range / [default setting]	Information
0x2652:002	Analog input configuration: X3.1 IOL1 AI1 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x265202xx (with xx = number of bits used)
0x2652:003	Analog input configuration: X3.1 IOL1 AI1 target address 0 ... [**0**] ... 4294967295	Display of the unscaled value.
0x2652:004	Analog input configuration: X3.1 IOL1 AI1 scaled value • Read only	Display of the scaled value.
0x2652:005	Analog input configuration: X3.1 IOL1 AI1 data type input 0 Signed **1 Unsigned**	
0x2652:006	Analog input configuration: X3.1 IOL1 AI1 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:007	Analog input configuration: X3.1 IOL1 AI1 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:008	Analog input configuration: X3.1 IOL1 AI1 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:009	Analog input configuration: X3.1 IOL1 AI1 data type output 0 Signed **1 Unsigned**	
0x2652:010	Analog input configuration: X3.1 IOL1 AI1 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:011	Analog input configuration: X3.1 IOL1 AI1 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:012	Analog input configuration: X3.1 IOL1 AI1 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	



Address	Name / setting range / [default setting]		Information
0x2652:015	Analog input configuration: X3.1 IOL1 AI1 status		To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0	**Inactive**	
	1	Active	
	10	Error too less bits IN	
	11	Error too less bits OUT	
	12	Error too many bits IN	
	13	Error too many bits OUT	
	14	Error invalid min IN	
	15	Error invalid max IN	
	17	Error invalid max OUT	
	18	Error max smaller min IN	
	19	Error max smaller min OUT	
0x2652:017	Analog input configuration: X3.1 IOL1 AI2 source value • Read only		Parameter object that can be assigned to the process input data of IO-Link port 1 via the IOL1-RPDO mapping (0x24D0:001 ... 0x24D0:016). • Mapping entry = 0x265211xx (with xx = number of bits used)
0x2652:018	Analog input configuration: X3.1 IOL1 AI2 target address 0 ... [**0**] ... 4294967295		Display of the unscaled value.
0x2652:019	Analog input configuration: X3.1 IOL1 AI2 scaled value • Read only		Display of the scaled value.
0x2652:020	Analog input configuration: X3.1 IOL1 AI2 data type input		
	0	Signed	
	1	**Unsigned**	
0x2652:021	Analog input configuration: X3.1 IOL1 AI2 bits input 2 ... [**16**] ... 32		Number of the valid bits.
0x2652:022	Analog input configuration: X3.1 IOL1 AI2 scaling #A1min -2147483648 ... [**0**] ... 2147483647		Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:023	Analog input configuration: X3.1 IOL1 AI2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647		
0x2652:024	Analog input configuration: X3.1 IOL1 AI2 data type output		
	0	Signed	
	1	**Unsigned**	
0x2652:025	Analog input configuration: X3.1 IOL1 AI2 bits output 2 ... [**16**] ... 32		Number of the valid bits.
0x2652:026	Analog input configuration: X3.1 IOL1 AI2 scaling #B1min -2147483648 ... [**0**] ... 2147483647		Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:027	Analog input configuration: X3.1 IOL1 AI2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647		
0x2652:030	Analog input configuration: X3.1 IOL1 AI2 status • For further possible settings, see parameter 0x2652:015. 📖 232		To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0	**Inactive**	

11.6.5.2 IO-Link port 2

Analog input configuration for IO-Link port 2:

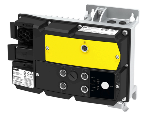


① Data mapping 📖 208
② Display of unscaled analog values
③ Scaling
④ Display of scaled analog values
⑤ Optional mapping of the scaled analog values to parameters of the inverter

The analog inputs can not only be used as frequency setpoint source, but are also available for selection in other parameters.

Parameter

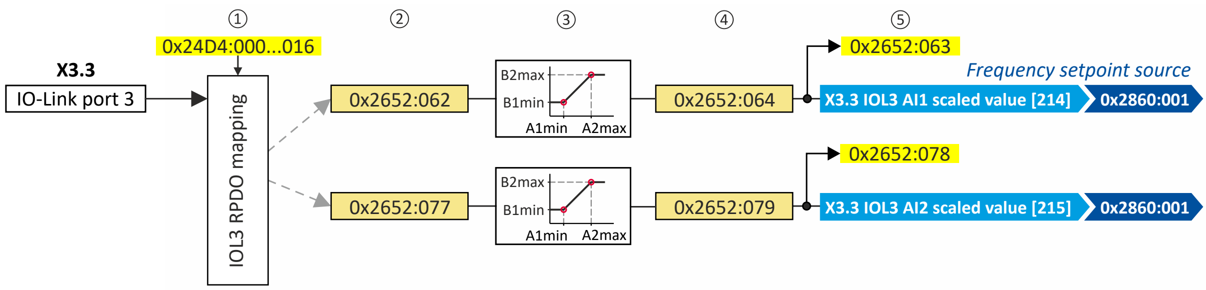
Address	Name / setting range / [default setting]	Information
0x2652:032	Analog input configuration: X3.2 IOL2 AI1 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016). • Mapping entry = 0x265220xx (with xx = number of bits used)
0x2652:033	Analog input configuration: X3.2 IOL2 AI1 target address 0 ... **[0]** ... 4294967295	Display of the unscaled value.
0x2652:034	Analog input configuration: X3.2 IOL2 AI1 scaled value • Read only	Display of the scaled value.
0x2652:035	Analog input configuration: X3.2 IOL2 AI1 data type input 0 Signed **1 Unsigned**	
0x2652:036	Analog input configuration: X3.2 IOL2 AI2 bits input 2 ... **[16]** ... 32	Number of the valid bits.
0x2652:037	Analog input configuration: X3.2 IOL2 AI1 scaling #A1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:038	Analog input configuration: X3.2 IOL2 AI1 scaling #A2max -2147483648 ... **[65535]** ... 2147483647	
0x2652:039	Analog input configuration: X3.2 IOL2 AI1 data type output 0 Signed **1 Unsigned**	
0x2652:040	Analog input configuration: X3.2 IOL2 AI1 bits output 2 ... **[16]** ... 32	Number of the valid bits.
0x2652:041	Analog input configuration: X3.2 IOL2 AI1 scaling #B1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:042	Analog input configuration: X3.2 IOL2 AI1 scaling #B2max -2147483648 ... **[65535]** ... 2147483647	
0x2652:045	Analog input configuration: X3.2 IOL2 AI1 status • For further possible settings, see parameter 0x2652:015. 📖 232 **0 Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
0x2652:047	Analog input configuration: X3.2 IOL2 AI2 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 2 via the IOL2-RPDO mapping (0x24D2:001 ... 0x24D2:016). • Mapping entry = 0x26522Fxx (with xx = number of bits used)



Address	Name / setting range / [default setting]	Information
0x2652:048	Analog input configuration: X3.2 IOL2 AI2 target address 0 ... **[0]** ... 4294967295	Display of the unscaled value.
0x2652:049	Analog input configuration: X3.2 IOL2 AI2 scaled value • Read only	Display of the scaled value.
0x2652:050	Analog input configuration: X3.2 IOL2 AI2 data type input 0 Signed **1 Unsigned**	
0x2652:051	Analog input configuration: X3.2 IOL2 AI2 bits input 2 ... **[16]** ... 32	Number of the valid bits.
0x2652:052	Analog input configuration: X3.2 IOL2 AI2 scaling #A1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:053	Analog input configuration: X3.2 IOL2 AI2 scaling #A2max -2147483648 ... **[65535]** ... 2147483647	
0x2652:054	Analog input configuration: X3.2 IOL2 AI2 data type output 0 Signed **1 Unsigned**	
0x2652:055	Analog input configuration: X3.2 IOL2 AI2 bits output 2 ... **[16]** ... 32	Number of the valid bits.
0x2652:056	Analog input configuration: X3.2 IOL2 AI2 scaling #B1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:057	Analog input configuration: X3.2 IOL2 AI2 scaling #B2max -2147483648 ... **[65535]** ... 2147483647	
0x2652:060	Analog input configuration: X3.2 IOL2 AI2 status • For further possible settings, see parameter 0x2652:015. 232 **0 Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.

11.6.5.3 IO-Link port 3

Analog input configuration for IO-Link port 3:



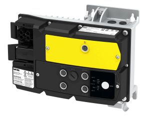
① Data mapping 208
② Display of unscaled analog values
③ Scaling
④ Display of scaled analog values
⑤ Optional mapping of the scaled analog values to parameters of the inverter

The analog inputs can not only be used as frequency setpoint source, but are also available for selection in other parameters.

Parameter

Address	Name / setting range / [default setting]	Information
0x2652:062	Analog input configuration: X3.3 IOL3 AI1 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016). • Mapping entry = 0x26523Exx (with xx = number of bits used)

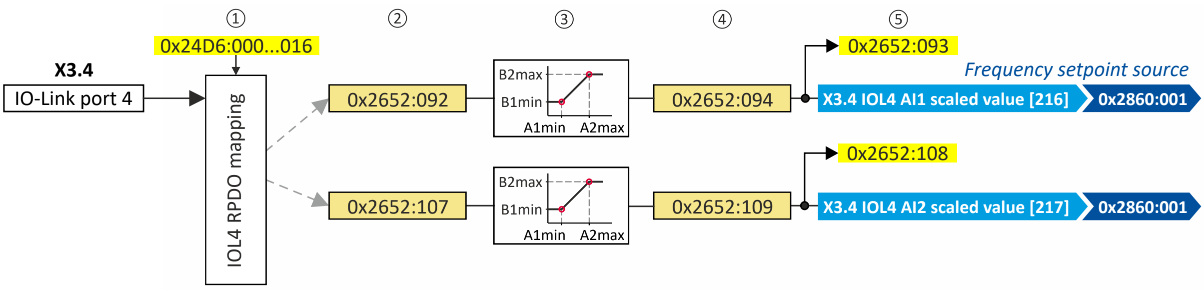
Address	Name / setting range / [default setting]	Information
0x2652:063	Analog input configuration: X3.3 IOL3 AI1 target address 0 ... [**0**] ... 4294967295	Display of the unscaled value.
0x2652:064	Analog input configuration: X3.3 IOL3 AI1 scaled value • Read only	Display of the scaled value.
0x2652:065	Analog input configuration: X3.3 IOL3 AI1 data type input 0 Signed **1 Unsigned**	
0x2652:066	Analog input configuration: X3.3 IOL3 AI1 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:067	Analog input configuration: X3.3 IOL3 AI1 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:068	Analog input configuration: X3.3 IOL3 AI1 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:069	Analog input configuration: X3.3 IOL3 AI1 data type output 0 Signed **1 Unsigned**	
0x2652:070	Analog input configuration: X3.3 IOL3 AI1 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:071	Analog input configuration: X3.3 IOL3 AI1 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:072	Analog input configuration: X3.3 IOL3 AI1 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:075	Analog input configuration: X3.3 IOL3 AI1 status • For further possible settings, see parameter 0x2652:015. 232 **0 Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
0x2652:077	Analog input configuration: X3.3 IOL3 AI2 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 3 via the IOL3-RPDO mapping (0x24D4:001 ... 0x24D4:016). • Mapping entry = 0x26524Dxx (with xx = number of bits used)
0x2652:078	Analog input configuration: X3.3 IOL3 AI2 target address 0 ... [**0**] ... 4294967295	Display of the unscaled value.
0x2652:079	Analog input configuration: X3.3 IOL3 AI2 scaled value • Read only	Display of the scaled value.
0x2652:080	Analog input configuration: X3.3 IOL3 AI2 data type input 0 Signed **1 Unsigned**	
0x2652:081	Analog input configuration: X3.3 IOL3 AI2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:082	Analog input configuration: X3.3 IOL3 AI2 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:083	Analog input configuration: X3.3 IOL3 AI2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:084	Analog input configuration: X3.3 IOL3 AI2 data type output 0 Signed **1 Unsigned**	
0x2652:085	Analog input configuration: X3.3 IOL3 AI2 bits output 2 ... [**16**] ... 32	Number of the valid bits.



Address	Name / setting range / [default setting]	Information
0x2652:086	Analog input configuration: X3.3 IOL3 AI2 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:087	Analog input configuration: X3.3 IOL3 AI2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:090	Analog input configuration: X3.3 IOL3 AI2 status • For further possible settings, see parameter 0x2652:015. 📖 232 **0** **Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.

11.6.5.4 IO-Link port 4

Analog input configuration for IO-Link port 4:



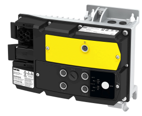
① Data mapping 📖 208
② Display of unscaled analog values
③ Scaling
④ Display of scaled analog values
⑤ Optional mapping of the scaled analog values to parameters of the inverter

The analog inputs can not only be used as frequency setpoint source, but are also available for selection in other parameters.

Parameter

Address	Name / setting range / [default setting]	Information
0x2652:092	Analog input configuration: X3.4 IOL4 AI1 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016). • Mapping entry = 0x26525Cxx (with xx = number of bits used)
0x2652:093	Analog input configuration: X3.4 IOL4 AI1 target address 0 ... [**0**] ... 4294967295	Display of the unscaled value.
0x2652:094	Analog input configuration: X3.4 IOL4 AI1 scaled value • Read only	Display of the scaled value.
0x2652:095	Analog input configuration: X3.4 IOL4 AI1 data type input 0 Signed **1** **Unsigned**	
0x2652:096	Analog input configuration: X3.4 IOL4 AI2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:097	Analog input configuration: X3.4 IOL4 AI1 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:098	Analog input configuration: X3.4 IOL4 AI1 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:099	Analog input configuration: X3.4 IOL4 AI1 data type output 0 Signed **1** **Unsigned**	
0x2652:100	Analog input configuration: X3.4 IOL4 AI1 bits output 2 ... [**16**] ... 32	Number of the valid bits.

Address	Name / setting range / [default setting]	Information
0x2652:101	Analog input configuration: X3.4 IOL4 AI1 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:102	Analog input configuration: X3.4 IOL4 AI1 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:105	Analog input configuration: X3.4 IOL4 AI1 status • For further possible settings, see parameter 0x2652:015. 232 **0** **Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
0x2652:107	Analog input configuration: X3.4 IOL4 AI2 source value • Read only	Parameter object that can be assigned to the process input data of IO-Link port 4 via the IOL4-RPDO mapping (0x24D6:001 ... 0x24D6:016). • Mapping entry = 0x26526Bxx (with xx = number of bits used)
0x2652:108	Analog input configuration: X3.4 IOL4 AI2 target address 0 ... [**0**] ... 4294967295	Display of the unscaled value.
0x2652:109	Analog input configuration: X3.4 IOL4 AI2 scaled value • Read only	Display of the scaled value.
0x2652:110	Analog input configuration: X3.4 IOL4 AI2 data type input 0 Signed **1** **Unsigned**	
0x2652:111	Analog input configuration: X3.4 IOL4 AI2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:112	Analog input configuration: X3.4 IOL4 AI2 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:113	Analog input configuration: X3.4 IOL4 AI2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:114	Analog input configuration: X3.4 IOL4 AI2 data type output 0 Signed **1** **Unsigned**	
0x2652:115	Analog input configuration: X3.4 IOL4 AI2 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2652:116	Analog input configuration: X3.4 IOL4 AI2 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2652:117	Analog input configuration: X3.4 IOL4 AI2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2652:120	Analog input configuration: X3.4 IOL4 AI2 status • For further possible settings, see parameter 0x2652:015. 232 **0** **Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.



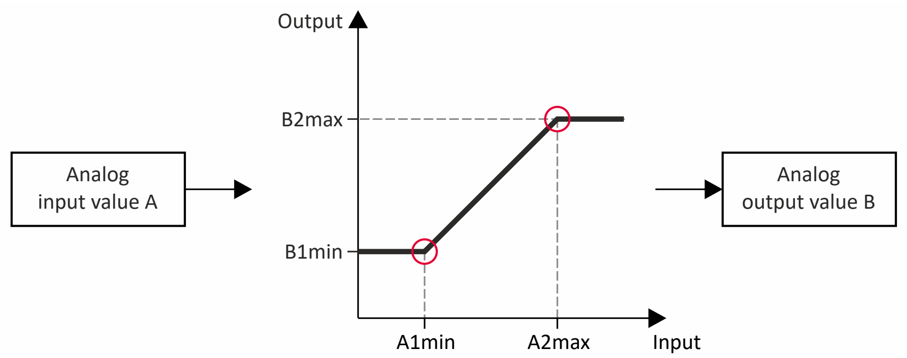
11.6.6 Analog output configuration

Selection and configuration of the inverter's internal analog values for output via IO-Link.

Details

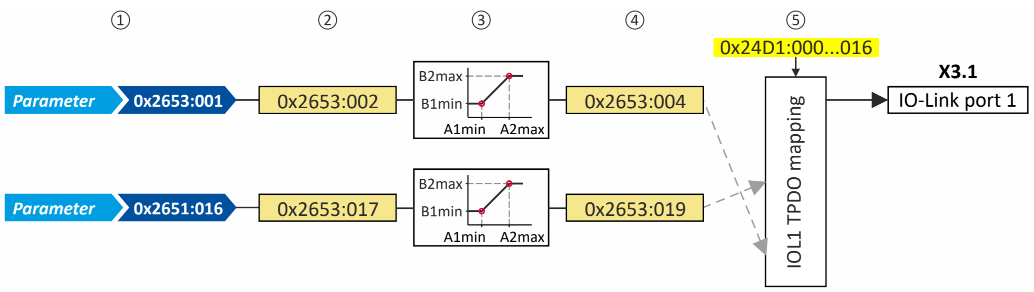
Analog values of internal parameters can be sent to IO-Link process output data. Each analog output can be assigned an internal analog value of the inverter.

- 2 analog outputs are available for each IO-Link port.
- For each analog output there is a parameter object that can be assigned to the corresponding IO-Link process output data via the data mapping.
  Note: Each port has its own output signals. It is not allowed to enter a signal from another port in the process data mapping.
- The analog values can have a data length of 2 ... 32 bit.
- A scaling can be parameterized for the analog values:



11.6.6.1 IO-Link port 1

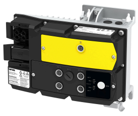
Analog output configuration for IO-Link port 1:



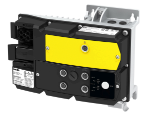
① Mapping of the analog values
② Display of unscaled analog values
③ Scaling
④ mappable objects (scaled analog values)
⑤ Data mapping 208

Parameter

Address	Name / setting range / [default setting]	Information
0x2653:001	Analog output configuration: X3.1 IOL1 AO1 source address 0 ... **[0]** ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:002	Analog output configuration: X3.1 IOL1 AO1 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 1). The value of the mapped parameter is the input value for scaling.
0x2653:004	Analog output configuration: X3.1 IOL1 AO1 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 1 via the IOL1 TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x265304xx (with xx = number of bits used)



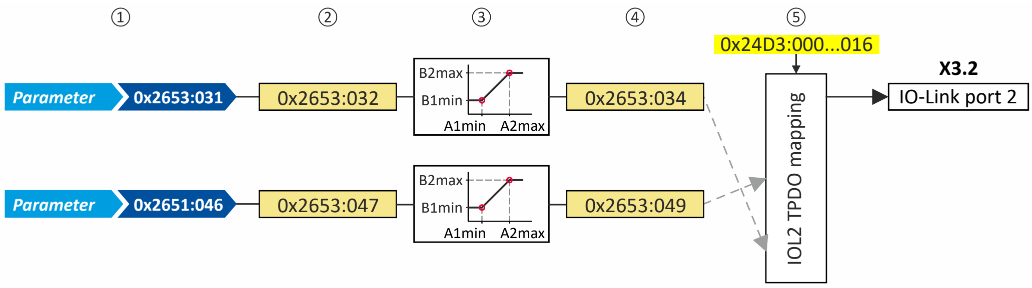
Address	Name / setting range / [default setting]	Information
0x2653:005	Analog output configuration: X3.1 IOL1 AO1 data type input	
	0 Signed	
	1 Unsigned	
0x2653:006	Analog output configuration: X3.1 IOL1 AO1 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:007	Analog output configuration: X3.1 IOL1 AO1 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:008	Analog output configuration: X3.1 IOL1 AO1 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:009	Analog output configuration: X3.1 IOL1 AO1 data type output	
	0 Signed	
	1 Unsigned	
0x2653:010	Analog output configuration: X3.1 IOL1 AO1 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:011	Analog output configuration: X3.1 IOL1 AO1 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:012	Analog output configuration: X3.1 IOL1 AO1 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:015	Analog output configuration: X3.1 IOL1 AO1 status • For further possible settings, see parameter 0x2652:015. 232	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0 Inactive	
0x2653:016	Analog output configuration: X3.1 IOL1 AO2 source address 0 ... [**0**] ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:017	Analog output configuration: X3.1 IOL1 AO2 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 16). The value of the mapped parameter is the input value for scaling.
0x2653:019	Analog output configuration: X3.1 IOL1 AO2 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 1 via the IOL1 TPDO mapping (0x24D1:001 ... 0x24D1:016). • Mapping entry = 0x265313xx (with xx = number of bits used)
0x2653:020	Analog output configuration: X3.1 IOL1 AO2 data type input	
	0 Signed	
	1 Unsigned	
0x2653:021	Analog output configuration: X3.1 IOL1 AO2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:022	Analog output configuration: X3.1 IOL1 AO2 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:023	Analog output configuration: X3.1 IOL1 AO2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:024	Analog output configuration: X3.1 IOL1 AO2 data type output	
	0 Signed	
	1 Unsigned	



Address	Name / setting range / [default setting]	Information
0x2653:025	Analog output configuration: X3.1 IOL1 AO2 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:026	Analog output configuration: X3.1 IOL1 AO2 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:027	Analog output configuration: X3.1 IOL1 AO2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:030	Analog output configuration: X3.1 IOL1 AO2 status • For further possible settings, see parameter 0x2652:015. 📖 232 **0** | **Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.

11.6.6.2 IO-Link port 2

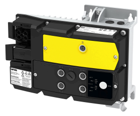
Analog output configuration for IO-Link port 2:



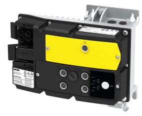
① Mapping of the analog values
② Display of unscaled analog values
③ Scaling
④ mappable objects (scaled analog values)
⑤ Data mapping 📖 208

Parameter

Address	Name / setting range / [default setting]	Information
0x2653:031	Analog output configuration: X3.2 IOL2 AO1 source address 0 ... [**0**] ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:032	Analog output configuration: X3.2 IOL2 AO1 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 31). The value of the mapped parameter is the input value for scaling.
0x2653:034	Analog output configuration: X3.2 IOL2 AO1 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 2 via the IOL2 TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x265322xx (with xx = number of bits used)
0x2653:035	Analog output configuration: X3.2 IOL2 AO1 data type input 0 | Signed **1** | **Unsigned**	
0x2653:036	Analog output configuration: X3.2 IOL2 AO1 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:037	Analog output configuration: X3.2 IOL2 AO1 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:038	Analog output configuration: X3.2 IOL2 AO1 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	

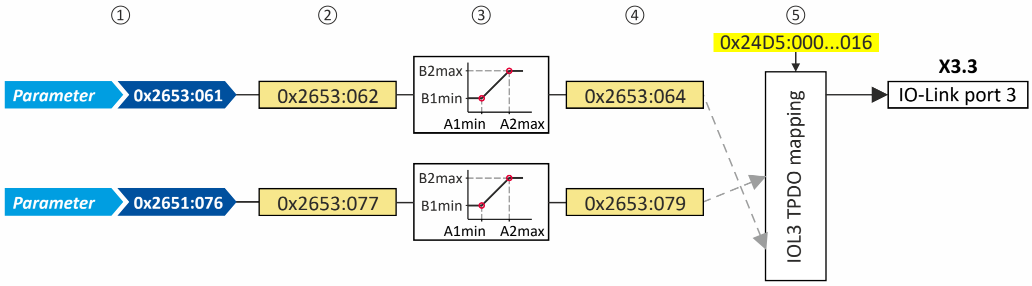


Address	Name / setting range / [default setting]	Information
0x2653:039	Analog output configuration: X3.2 IOL2 AO1 data type output	
	0 Signed	
	1 Unsigned	
0x2653:040	Analog output configuration: X3.2 IOL2 AO1 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:041	Analog output configuration: X3.2 IOL2 AO1 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:042	Analog output configuration: X3.2 IOL2 AO1 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:045	Analog output configuration: X3.2 IOL2 AO1 status • For further possible settings, see parameter 0x2652:015. 232	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0 Inactive	
0x2653:046	Analog output configuration: X3.2 IOL2 AO2 source address 0 ... [**0**] ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:047	Analog output configuration: X3.2 IOL2 AO2 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 46). The value of the mapped parameter is the input value for scaling.
0x2653:049	Analog output configuration: X3.2 IOL2 AO2 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 2 via the IOL2 TPDO mapping (0x24D3:001 ... 0x24D3:016). • Mapping entry = 0x265331xx (with xx = number of bits used)
0x2653:050	Analog output configuration: X3.2 IOL2 AO2 data type input	
	0 Signed	
	1 Unsigned	
0x2653:051	Analog output configuration: X3.2 IOL2 AO2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:052	Analog output configuration: X3.2 IOL2 AO2 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:053	Analog output configuration: X3.2 IOL2 AO2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:054	Analog output configuration: X3.2 IOL2 AO2 data type output	
	0 Signed	
	1 Unsigned	
0x2653:055	Analog output configuration: X3.2 IOL2 AO2 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:056	Analog output configuration: X3.2 IOL2 AO2 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:057	Analog output configuration: X3.2 IOL2 AO2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:060	Analog output configuration: X3.2 IOL2 AO2 status • For further possible settings, see parameter 0x2652:015. 232	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0 Inactive	



11.6.6.3 IO-Link port 3

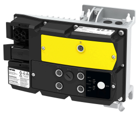
Analog output configuration for IO-Link port 3:



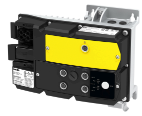
① Mapping of the analog values
② Display of unscaled analog values
③ Scaling
④ mappable objects (scaled analog values)
⑤ Data mapping 208

Parameter

Address	Name / setting range / [default setting]	Information
0x2653:061	Analog output configuration: X3.3 IOL3 AO1 source address 0 ... **[0]** ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:062	Analog output configuration: X3.3 IOL3 AO1 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 61). The value of the mapped parameter is the input value for scaling.
0x2653:064	Analog output configuration: X3.3 IOL3 AO1 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 3 via the IOL3 TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x265340xx (with xx = number of bits used)
0x2653:065	Analog output configuration: X3.3 IOL3 AO1 data type input 0 Signed **1 Unsigned**	
0x2653:066	Analog output configuration: X3.3 IOL3 AO1 bits input 2 ... **[16]** ... 32	Number of the valid bits.
0x2653:067	Analog output configuration: X3.3 IOL3 AO1 scaling #A1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:068	Analog output configuration: X3.3 IOL3 AO1 scaling #A2max -2147483648 ... **[65535]** ... 2147483647	
0x2653:069	Analog output configuration: X3.3 IOL3 AO1 data type output 0 Signed **1 Unsigned**	
0x2653:070	Analog output configuration: X3.3 IOL3 AO1 bits output 2 ... **[16]** ... 32	Number of the valid bits.
0x2653:071	Analog output configuration: X3.3 IOL3 AO1 scaling #B1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:072	Analog output configuration: X3.3 IOL3 AO1 scaling #B2max -2147483648 ... **[65535]** ... 2147483647	
0x2653:075	Analog output configuration: X3.3 IOL3 AO1 status • For further possible settings, see parameter 0x2652:015. 232 **0 Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.

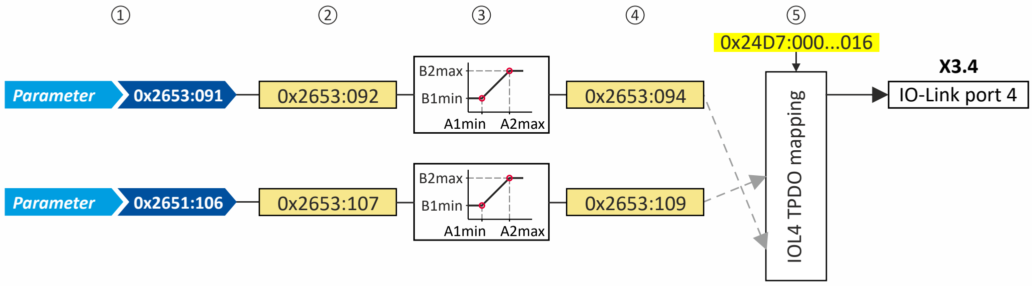


Address	Name / setting range / [default setting]	Information
0x2653:076	Analog output configuration: X3.3 IOL3 AO2 source address 0 ... [**0**] ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:077	Analog output configuration: X3.3 IOL3 AO2 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 76). The value of the mapped parameter is the input value for scaling.
0x2653:079	Analog output configuration: X3.3 IOL3 AO2 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 3 via the IOL3 TPDO mapping (0x24D5:001 ... 0x24D5:016). • Mapping entry = 0x26534Fxx (with xx = number of bits used)
0x2653:080	Analog output configuration: X3.3 IOL3 AO2 data type input 0 Signed **1 Unsigned**	
0x2653:081	Analog output configuration: X3.3 IOL3 AO2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:082	Analog output configuration: X3.3 IOL3 AO2 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:083	Analog output configuration: X3.3 IOL3 AO2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:084	Analog output configuration: X3.3 IOL3 AO2 data type output 0 Signed **1 Unsigned**	
0x2653:085	Analog output configuration: X3.3 IOL3 AO2 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:086	Analog output configuration: X3.3 IOL3 AO2 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:087	Analog output configuration: X3.3 IOL3 AO2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:090	Analog output configuration: X3.3 IOL3 AO2 status • For further possible settings, see parameter 0x2652:015. 232 **0 Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.



11.6.6.4 IO-Link port 4

Analog output configuration for IO-Link port 4:



① Mapping of the analog values
② Display of unscaled analog values
③ Scaling
④ mappable objects (scaled analog values)
⑤ Data mapping 📖 208

Parameter

Address	Name / setting range / [default setting]		Information
0x2653:091	Analog output configuration: X3.4 IOL4 AO1 source address 0 ... **[0]** ... 4294967295		Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:092	Analog output configuration: X3.4 IOL4 AO1 source value • Read only		Parameter object into which the value of a parameter is written by means of mapping (subindex 91). The value of the mapped parameter is the input value for scaling.
0x2653:094	Analog output configuration: X3.4 IOL4 AO1 scaled value • Read only		Parameter object with scaled value that can be assigned to the process output data of IO-Link port 4 via the IOL4 TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26535Exx (with xx = number of bits used)
0x2653:095	Analog output configuration: X3.4 IOL4 AO1 data type input		
	0	Signed	
	1	**Unsigned**	
0x2653:096	Analog output configuration: X3.4 IOL4 AO1 bits input 2 ... **[16]** ... 32		Number of the valid bits.
0x2653:097	Analog output configuration: X3.4 IOL4 AO1 scaling #A1min -2147483648 ... **[0]** ... 2147483647		Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:098	Analog output configuration: X3.4 IOL4 AO1 scaling #A2max -2147483648 ... **[65535]** ... 2147483647		
0x2653:099	Analog output configuration: X3.4 IOL4 AO1 data type output		
	0	Signed	
	1	**Unsigned**	
0x2653:100	Analog output configuration: X3.4 IOL4 AO1 bits output 2 ... **[16]** ... 32		Number of the valid bits.
0x2653:101	Analog output configuration: X3.4 IOL4 AO1 scaling #B1min -2147483648 ... **[0]** ... 2147483647		Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:102	Analog output configuration: X3.4 IOL4 AO1 scaling #B2max -2147483648 ... **[65535]** ... 2147483647		
0x2653:105	Analog output configuration: X3.4 IOL4 AO1 status • For further possible settings, see parameter 0x2652:015. 📖 232		To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0	**Inactive**	

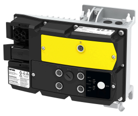
Address	Name / setting range / [default setting]	Information
0x2653:106	Analog output configuration: X3.4 IOL4 AO2 source address 0 ... [**0**] ... 4294967295	Mapping of the parameter whose analog value is to be output via IO-Link. • Format of the mapping entry: 0xiiiissll (iiii = Index, ss = Subindex, ll = length in bits) • Transmit mapping must be allowed for the mapped parameter.
0x2653:107	Analog output configuration: X3.4 IOL4 AO2 source value • Read only	Parameter object into which the value of a parameter is written by means of mapping (subindex 106). The value of the mapped parameter is the input value for scaling.
0x2653:109	Analog output configuration: X3.4 IOL4 AO2 scaled value • Read only	Parameter object with scaled value that can be assigned to the process output data of IO-Link port 4 via the IOL4 TPDO mapping (0x24D7:001 ... 0x24D7:016). • Mapping entry = 0x26536Dxx (with xx = number of bits used)
0x2653:110	Analog output configuration: X3.4 IOL4 AO2 data type input 0 Signed **1** **Unsigned**	
0x2653:111	Analog output configuration: X3.4 IOL4 AO2 bits input 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:112	Analog output configuration: X3.4 IOL4 AO2 scaling #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:113	Analog output configuration: X3.4 IOL4 AO2 scaling #A2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:114	Analog output configuration: X3.4 IOL4 AO2 data type output 0 Signed **1** **Unsigned**	
0x2653:115	Analog output configuration: X3.4 IOL4 AO2 bits output 2 ... [**16**] ... 32	Number of the valid bits.
0x2653:116	Analog output configuration: X3.4 IOL4 AO2 scaling #B1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2653:117	Analog output configuration: X3.4 IOL4 AO2 scaling #B2max -2147483648 ... [**65535**] ... 2147483647	
0x2653:120	Analog output configuration: X3.4 IOL4 AO2 status • For further possible settings, see parameter 0x2652:015. 232 **0** **Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.

11.6.7 Diagnostics

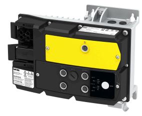
The following parameters display diagnostic information on the IO-Link ports 1 ... 4 according to the IO-Link standard.

Parameter

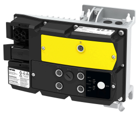
Address	Name / setting range / [default setting]	Information
0x24A1:001	IO-Link port 1: Current vendor ID • Read only	
0x24A1:002	IO-Link port 1: Current device ID • Read only	
0x24A1:003	IO-Link port 1: Product name • Read only	
0x24A1:004	IO-Link port 1: Firmware version • Read only	
0x24A1:005	IO-Link port 1: Serial number • Read only	
0x24A1:021	IO-Link port 1: Communication status • Read only	
	0 NO_DEVICE	
	1 DEACTIVATED	
	2 PORT_DIAG	
	3 PREOPERATE	
	4 OPERATE	
	5 DI_C/Q	
	6 DO_C/Q	
	254 POWER_PORT_OFF	
	255 NOT_AVAILABLE	
0x24A1:022	IO-Link port 1: Current cycle time • Read only: x.x ms	
0x24A1:023	IO-Link port 1: RPDO data length • Read only	
0x24A1:024	IO-Link port 1: Received RPDO data • Read only	The data starts with the last mapping entry and ends with the first mapping entry.
0x24A1:025	IO-Link port 1: TPDO data length • Read only	
0x24A1:026	IO-Link port 1: Transmitted TPDO data ["**0**"]	The data starts with the last mapping entry and ends with the first mapping entry. If "Override output data" is activated in subindex 27, the process output data can be entered manually here.
0x24A1:027	IO-Link port 1: Enable TPDO data	
	0 No action	
	20 Force output data	
0x24A1:028	IO-Link port 1: Status PDO data • Read only	Status is bit-coded: • Bit 0: Process input data valid • Bit 1: Process output data valid
	Bit 0 RPDO valid	
	Bit 1 TPDO valid	
0x24A1:029	IO-Link port 1: SDCI protocol • Read only	Display of the SDCI protocol version.
0x24A1:030	IO-Link port 1: Transmission rate • Read only	
	0 Not detected	
	1 COM1	
	2 COM2	
	3 COM3	
0x24A1:049	IO-Link port 1: Diagnostic data length • Read only	Display of the number of existing diagnostic entries.



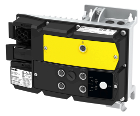
Address	Name / setting range / [default setting]		Information
0x24A1:050	IO-Link port 1: Diagnostic entry 0 • Read only		Meaning: • EventCode (Masking 0x0000FFFF) • Instance (Masking 0x00070000): 4 = Application • Source (Masking 0x00080000): 0 = Device, 1 = Master/Port • Type (Masking 0x00300000): 1 = Notification, 2 = Warning, 3 = Error • Mode (Masking 0x00C00000): 1 = Single shot, 2 = Disappears, 3 = Appears
0x24A1:051	IO-Link port 1: Diagnostic entry 1 • Read only		
0x24A1:052	IO-Link port 1: Diagnostic entry 2 • Read only		
0x24A1:053	IO-Link port 1: Diagnostic entry 3 • Read only		
0x24A1:054	IO-Link port 1: Diagnostic entry 4 • Read only		
0x24A1:055	IO-Link port 1: Diagnostic entry 5 • Read only		
0x24A1:056	IO-Link port 1: Diagnostic entry 6 • Read only		
0x24A1:057	IO-Link port 1: Diagnostic entry 7 • Read only		
0x24A1:058	IO-Link port 1: Diagnostic entry 8 • Read only		
0x24A1:059	IO-Link port 1: Diagnostic entry 9 • Read only		
0x24A2:001	IO-Link port 2: Current vendor ID • Read only		
0x24A2:002	IO-Link port 2: Current device ID • Read only		
0x24A2:003	IO-Link port 2: Product name • Read only		
0x24A2:004	IO-Link port 2: Firmware version • Read only		
0x24A2:005	IO-Link port 2: Serial number • Read only		
0x24A2:021	IO-Link port 2: Communication status • Read only		
	0	NO_DEVICE	
	1	DEACTIVATED	
	2	PORT_DIAG	
	3	PREOPERATE	
	4	OPERATE	
	5	DI_C/Q	
	6	DO_C/Q	
	254	POWER_PORT_OFF	
	255	NOT_AVAILABLE	
0x24A2:022	IO-Link port 2: Current cycle time • Read only: x.x ms		
0x24A2:023	IO-Link port 2: RPDO data length • Read only		
0x24A2:024	IO-Link port 2: Received RPDO data • Read only		The data starts with the last mapping entry and ends with the first mapping entry.
0x24A2:025	IO-Link port 2: TPDO data length • Read only		
0x24A2:026	IO-Link port 2: Transmitted TPDO data ["**0**"]		The data starts with the last mapping entry and ends with the first mapping entry. If "Override output data" is activated in subindex 27, the process output data can be entered manually here.
0x24A2:027	IO-Link port 2: Enable TPDO data		
	0	**No action**	
	20	Force output data	



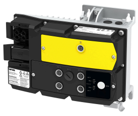
Address	Name / setting range / [default setting]		Information
0x24A2:028	IO-Link port 2: Status PDO data • Read only		Status is bit-coded: • Bit 0: Process input data valid • Bit 1: Process output data valid
	Bit 0	RPDO valid	
	Bit 1	TPDO valid	
0x24A2:029	IO-Link port 2: Lenght of diagnostic data • Read only		Display of the SDCI protocol version.
0x24A2:030	IO-Link port 2: Transmission rate • Read only		
	0	Not detected	
	1	COM1	
	2	COM2	
	3	COM3	
0x24A2:049	IO-Link port 2: Diagnostic data length • Read only		Display of the number of existing diagnostic entries.
0x24A2:050	IO-Link port 2: Diagnostic entry 0 • Read only		Meaning: • EventCode (Masking 0x0000FFFF) • Instance (Masking 0x00070000): 4 = Application • Source (Masking 0x00080000): 0 = Device, 1 = Master/Port • Type (Masking 0x00300000): 1 = Notification, 2 = Warning, 3 = Error • Mode (Masking 0x00C00000): 1 = Single shot, 2 = Disappears, 3 = Appears
0x24A2:051	IO-Link port 2: Diagnostic entry 1 • Read only		
0x24A2:052	IO-Link port 2: Diagnostic entry 2 • Read only		
0x24A2:053	IO-Link port 2: Diagnostic entry 3 • Read only		
0x24A2:054	IO-Link port 2: Diagnostic entry 4 • Read only		
0x24A2:055	IO-Link port 2: Diagnostic entry 5 • Read only		
0x24A2:056	IO-Link port 2: Diagnostic entry 6 • Read only		
0x24A2:057	IO-Link port 2: Diagnostic entry 7 • Read only		
0x24A2:058	IO-Link port 2: Diagnostic entry 8 • Read only		
0x24A2:059	IO-Link port 2: Diagnostic entry 9 • Read only		



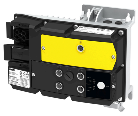
Address	Name / setting range / [default setting]	Information
0x24A3:001	IO-Link port 3: Current vendor ID • Read only	
0x24A3:002	IO-Link port 3: Current device ID • Read only	
0x24A3:003	IO-Link port 3: Product name • Read only	
0x24A3:004	IO-Link port 3: Firmware version • Read only	
0x24A3:005	IO-Link port 3: Serial number • Read only	
0x24A3:021	IO-Link port 3: Communication status • Read only	
	0 NO_DEVICE	
	1 DEACTIVATED	
	2 PORT_DIAG	
	3 PREOPERATE	
	4 OPERATE	
	5 DI_C/Q	
	6 DO_C/Q	
	254 POWER_PORT_OFF	
	255 NOT_AVAILABLE	
0x24A3:022	IO-Link port 3: Current cycle time • Read only: x.x ms	
0x24A3:023	IO-Link port 3: RPDO data length • Read only	
0x24A3:024	IO-Link port 3: Received RPDO data • Read only	The data starts with the last mapping entry and ends with the first mapping entry.
0x24A3:025	IO-Link port 3: TPDO data length • Read only	
0x24A3:026	IO-Link port 3: Transmitted TPDO data ["**0**"]	The data starts with the last mapping entry and ends with the first mapping entry. If "Override output data" is activated in subindex 27, the process output data can be entered manually here.
0x24A3:027	IO-Link port 3: Enable TPDO data	
	0 No action	
	20 Force output data	
0x24A3:028	IO-Link port 3: Status PDO data • Read only	Status is bit-coded: • Bit 0: Process input data valid • Bit 1: Process output data valid
	Bit 0 RPDO valid	
	Bit 1 TPDO valid	
0x24A3:029	IO-Link port 3: SDCI protocol • Read only	Display of the SDCI protocol version.
0x24A3:030	IO-Link port 3: Transmission rate • Read only	
	0 Not detected	
	1 COM1	
	2 COM2	
	3 COM3	
0x24A3:049	IO-Link port 3: Diagnostic data length • Read only	Display of the number of existing diagnostic entries.



Address	Name / setting range / [default setting]	Information
0x24A3:050	IO-Link port 3: Diagnostic entry 0 • Read only	Meaning: • EventCode (Masking 0x0000FFFF) • Instance (Masking 0x00070000): 4 = Application • Source (Masking 0x00080000): 0 = Device, 1 = Master/Port • Type (Masking 0x00300000): 1 = Notification, 2 = Warning, 3 = Error • Mode (Masking 0x00C00000): 1 = Single shot, 2 = Disappears, 3 = Appears
0x24A3:051	IO-Link port 3: Diagnostic entry 1 • Read only	
0x24A3:052	IO-Link port 3: Diagnostic entry 2 • Read only	
0x24A3:053	IO-Link port 3: Diagnostic entry 3 • Read only	
0x24A3:054	IO-Link port 3: Diagnostic entry 4 • Read only	
0x24A3:055	IO-Link port 3: Diagnostic entry 5 • Read only	
0x24A3:056	IO-Link port 3: Diagnostic entry 6 • Read only	
0x24A3:057	IO-Link port 3: Diagnostic entry 7 • Read only	
0x24A3:058	IO-Link port 3: Diagnostic entry 8 • Read only	
0x24A3:059	IO-Link port 3: Diagnostic entry 9 • Read only	
0x24A4:001	IO-Link port 4: Current vendor ID • Read only	
0x24A4:002	IO-Link port 4: Current device ID • Read only	
0x24A4:003	IO-Link port 4: Product name • Read only	
0x24A4:004	IO-Link port 4: Firmware version • Read only	
0x24A4:005	IO-Link port 4: Serial number • Read only	
0x24A4:021	IO-Link port 4: Communication status • Read only	
	0 NO_DEVICE	
	1 DEACTIVATED	
	2 PORT_DIAG	
	3 PREOPERATE	
	4 OPERATE	
	5 DI_C/Q	
	6 DO_C/Q	
	254 POWER_PORT_OFF	
	255 NOT_AVAILABLE	
0x24A4:022	IO-Link port 4: Current cycle time • Read only: x.x ms	
0x24A4:023	IO-Link port 4: RPDO data length • Read only	
0x24A4:024	IO-Link port 4: Received RPDO data • Read only	The data starts with the last mapping entry and ends with the first mapping entry.
0x24A4:025	IO-Link port 4: TPDO data length • Read only	
0x24A4:026	IO-Link port 4: Transmitted TPDO data ["**0**"]	The data starts with the last mapping entry and ends with the first mapping entry. If "Override output data" is activated in subindex 27, the process output data can be entered manually here.
0x24A4:027	IO-Link port 4: Enable TPDO data	
	0 No action	
	20 Force output data	



Address	Name / setting range / [default setting]	Information
0x24A4:028	IO-Link port 4: Status PDO data • Read only	Status is bit-coded: • Bit 0: Process input data valid • Bit 1: Process output data valid
	Bit 0 RPDO valid	
	Bit 1 TPDO valid	
0x24A4:029	IO-Link port 4: SDCI protocol • Read only	Display of the SDCI protocol version.
0x24A4:030	IO-Link port 4: Transmission rate • Read only	
	0 Not detected	
	1 COM1	
	2 COM2	
	3 COM3	
0x24A4:049	IO-Link port 4: Diagnostic data length • Read only	Display of the number of existing diagnostic entries.
0x24A4:050	IO-Link port 4: Diagnostic entry 0 • Read only	Meaning: • EventCode (Masking 0x0000FFFF) • Instance (Masking 0x00070000): 4 = Application • Source (Masking 0x00080000): 0 = Device, 1 = Master/Port • Type (Masking 0x00300000): 1 = Notification, 2 = Warning, 3 = Error • Mode (Masking 0x00C00000): 1 = Single shot, 2 = Disappears, 3 = Appears
0x24A4:051	IO-Link port 4: Diagnostic entry 1 • Read only	
0x24A4:052	IO-Link port 4: Diagnostic entry 2 • Read only	
0x24A4:053	IO-Link port 4: Diagnostic entry 3 • Read only	
0x24A4:054	IO-Link port 4: Diagnostic entry 4 • Read only	
0x24A4:055	IO-Link port 4: Diagnostic entry 5 • Read only	
0x24A4:056	IO-Link port 4: Diagnostic entry 6 • Read only	
0x24A4:057	IO-Link port 4: Diagnostic entry 7 • Read only	
0x24A4:058	IO-Link port 4: Diagnostic entry 8 • Read only	
0x24A4:059	IO-Link port 4: Diagnostic entry 9 • Read only	



11.7 Monitoring

Parameter

Address	Name / setting range / [default setting]		Information
0x2630:020	Settings for digital inputs: Overload error response		Selection of the error response when the output current at the 24 V output or at the digital outputs is too high. Associated error code: • 20864 | 0x5180 - Overload 24 V supply
	0	No response	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	**Fault**	

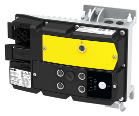
12 Configuring the network

The monitoring functions of the respective network are only active when network control is activated.

▶ Activate network control 📖 255

The following conventions are used in this documentation for specifying the parameter address:

- The index is specified as a hexadecimal value.
- The subindex is specified as a decimal value.



12.1 Network selection

The inverter supports the following Ethernet-based networks:

- EtherCAT 📖 304
- EtherNet/IP 📖 319
- Modbus TCP 📖 356
- PROFINET 📖 373

To provide the user with the expected functionality of one of these systems, the inverter is ordered for a specific network. The ordered network is then preset in the inverter (displayed in 0x231F:001).

The inverter itself has the firmware of all available networks on board and the user has the possibility to switch the inverter to another network.

Details

Switch to another network:

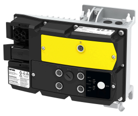
1. Set network in 0x231F:005.
2. Restart device (via Engineering Tool or 0x2022:035).

The inverter is switched to the newly selected network. All parameters associated with the old network are lost, but the drive parameters are retained.

Executing the device command "Load presets" (0x2022:001), uploading a new firmware or power cycles do not change the selected network.

Parameter

Address	Name / setting range / [default setting]		Information
0x231F:005	Communication module ID: Network selection • Setting can only be changed if the inverter is disabled.		Network selection. • A changed network only becomes effective after a restart of the device.
	71	EtherNet/IP	
	82	PROFINET	
	84	EtherCAT	
	86	Modbus TCP/IP	



12.2 Control the inverter via network

12.2.1 Activate network control

In order to be able to control the inverter via network, a trigger must be first assigned in 0x2631:037 to the "Activate network control" function.

- This trigger can for instance be the constant value "TRUE" or a digital input.
- If the assigned trigger is = TRUE, network control is activated and the motor can only be started via the network control word.
  Exception: Jog operation; see chapter "Start, stop and rotating direction commands" 📖 51

In case of an activated network control, the following functions are still active:

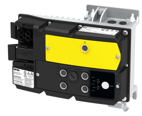
- 0x2631:001: Enable inverter
- 0x2631:002: Run
- 0x2631:003: Activate quick stop
- 0x2631:004: Reset error
- 0x2631:005: DC braking
- 0x2631:010: Jog forward (CW)
- 0x2631:011: Jog reverse (CCW)*
- 0x2631:037: Activate network control*
- 0x2631:043: Activate error 1
- 0x2631:044: Activate error 2

(*Not active in case of network operation in CiA402 mode 0x6060=2).

All other functions configurable via 0x2631:xxx are deactivated in case of network control.

Parameter

Address	Name / setting range / [default setting]		Information
0x2631:037	Function list: Activate network control • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Activate network control" function. Trigger = TRUE: Activate network control. Trigger = FALSE: no action / deactivate network control again.
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
	114	Network control active	TRUE if the network control is requested via bit 5 of the AC drive control word 0x400B:001. Otherwise FALSE. Notes: • Set this selection if the network control is to be activated via bit 5 of the AC drive control word. • The AC drive control word can be used with any communication protocol. ▸ AC drive control word 📖 302



12.2.2 Predefined control and status words

For establishing a simple network connection, the inverter provides predefined control and status words for the device profile CiA 402 and the AC drive profile.

Details

Process data are exchanged via cyclic data exchange between the network master and the inverter.

For the cyclic data exchange, the inverter is provided with 24 network registers.

- 12 network registers are provided as input registers for data words from the network master to the inverter.
- 12 network registers are provided as output registers for data words from the inverter to the network master.
- Each network register is provided with a corresponding code that defines which parameters (or other data codes) are mapped to the network register.
- The input and output registers are divided into three blocks (A, B, C) in each case, featuring 4 successive data words, respectively:

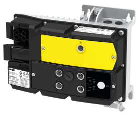
Network register	
Input register	**Output register**
Network IN A0 Network IN A1 Network IN A2 Network IN A3	Network OUT A0 Network OUT A1 Network OUT A2 Network OUT A3
Network IN B0 Network IN B1 Network IN B2 Network IN B3	Network OUT B0 Network OUT B1 Network OUT B2 Network OUT B3
Network IN C0 Network IN C1 Network IN C2 Network IN C3	Network OUT C0 Network OUT C1 Network OUT C2 Network OUT C3

The terms "input" and "output" refer to the point of view of the inverter:

- Input data are transmitted by the network master and received by the inverter.
- Output data are transmitted by the inverter and received by the network master.

The assignment of the network registers and the number of data words that can be transmitted cyclically varies according to the network/communication protocol. Detailed information can be found in the documentation for the respective communication protocol.

Data mapping cannot be applied to all parameters. The mappable parameters are indicated accordingly in the "Parameter attribute list". ▶ Parameter attribute list 📖 465



The following table lists the predefined control and status words. These can be mapped to network registers for the cyclic exchange of data:

Name	Parameter	Associated mapping entry *	Further information
CiA control word	0x6040	0x60400010	▶ CiA 402 device profile 🕮 280
CiA status word	0x6041	0x60410010	
AC Drive control word	0x400B:001	0x400B0110	▶ AC drive 🕮 302
AC Drive status word	0x400C:001	0x400C0110	
* A mapping entry consists of index, subindex and data length in bits of the parameter to be mapped.			

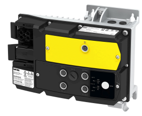
There are also additional mappable data words to individually control the inverter:

▶ Define your own control word format 🕮 258

▶ Define your own status word format 🕮 264

▶ Further mappable parameters 🕮 275

General information about the process of data mapping can be found in the chapter of the same name for the corresponding network.



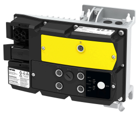
12.2.3 Define your own control word format

The mappable data word NetWordIN1 is available for implementing a separate control word format.

Details

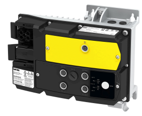
Designation	Parameter	Associated mapping entry *	Further information
NetWordIN1	0x4008:001	0x40080110	The functions that are to be triggered via bits 0 ... 15 of the NetWordIN1 data word are defined in 0x400E:001 ... 0x400E:016.
* A mapping entry consists of index, subindex and data length in bits of the parameter to be mapped.			

General information about the process of data mapping can be found in the chapter of the same name for the corresponding network.



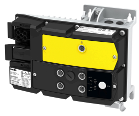
Parameter

Address	Name / setting range / [default setting]		Information
0x4008:001	Process input words: NetWordIN1 0x0000 ... [**0x0000**] ... 0xFFFF		Mappable data word for flexible control of the inverter via network.
	Bit 0	Mapping bit 0	Assignment of the function: 0x400E:001
	Bit 1	Mapping bit 1	Assignment of the function: 0x400E:002
	Bit 2	Mapping bit 2	Assignment of the function: 0x400E:003
	Bit 3	Mapping bit 3	Assignment of the function: 0x400E:004
	Bit 4	Mapping bit 4	Assignment of the function: 0x400E:005
	Bit 5	Mapping bit 5	Assignment of the function: 0x400E:006
	Bit 6	Mapping bit 6	Assignment of the function: 0x400E:007
	Bit 7	Mapping bit 7	Assignment of the function: 0x400E:008
	Bit 8	Mapping bit 8	Assignment of the function: 0x400E:009
	Bit 9	Mapping bit 9	Assignment of the function: 0x400E:010
	Bit 10	Mapping bit 10	Assignment of the function: 0x400E:011
	Bit 11	Mapping bit 11	Assignment of the function: 0x400E:012
	Bit 12	Mapping bit 12	Assignment of the function: 0x400E:013 Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: • Digital output 1: 0x2634:002 / selection [30] Note! Do not assign the mapping bit to a function and a digital output at the same time. A double assignment can cause an unpredictable drive behavior!
	Bit 13	Mapping bit 13	Assignment of the function: 0x400E:014 Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: • Digital output 1: 0x2634:002 / selection [31] Note! Do not assign the mapping bit to a function and a digital output at the same time. A double assignment can cause an unpredictable drive behavior!
	Bit 14	Mapping bit 14	Assignment of the function: 0x400E:015 Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: • Digital output 1: 0x2634:002 / selection [32] Note! Do not assign the mapping bit to a function and a digital output at the same time. A double assignment can cause an unpredictable drive behavior!
	Bit 15	Mapping bit 15	Assignment of the function: 0x400E:016 Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: • Digital output 1: 0x2634:002 / selection [33] Note! Do not assign the mapping bit to a function and a digital output at the same time. A double assignment can cause an unpredictable drive behavior!



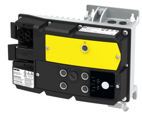
Address	Name / setting range / [default setting]	Information
0x400E:001	NetWordIN1 function: Bit 0 • Setting can only be changed if the inverter is disabled.	Definition of the function that is to be triggered via bit 0 of the mappable NetWordIN1 data word.
	0 Not active	Trigger bit without any function.
	1 Disable inverter	Trigger bit = 0-1 edge: The inverter is disabled. Trigger bit = 0: The inverter is enabled (unless there is another cause for inverter disable). Notes: • In all device states, a 0-1 edge causes an immediate change to the inhibited state with one exception: If the inverter is in the error status and the error condition still exists, the inverter remains in the error status. • Changing to the disabled state causes an immediate stop of the motor, regardless of the stop method set in 0x2838:003. The motor coasts down as a function of the mass inertia of the machine. • In the disabled state, the motor cannot be started. • After the inverter disable is deactivated, a renewed start command is required to restart the motor. • The cause(s) that are active for the disabled state are shown in 0x282A:001.
	2 Stopping	Trigger bit = 1: Motor is stopped. Trigger bit = 0: No action / Deactivate stop again. Notes: • The stop method can be selected in 0x2838:003.
	3 Activate quick stop	Trigger bit = 1: "Quick stop" function activated. Trigger bit = 0: no action / deactivate function again. Notes: • The "Quick stop" function brings the motor to a standstill within the deceleration time set in 0x291C. • The "Quick stop" function has a higher priority than the "Run" function.
	4 Reset error	Trigger bit = 0-1 edge: Active error is reset (acknowledged) if the error condition is not active anymore and the error is resettable. Trigger bit = 0: No action. Notes: • After resetting the error, a new enable/start command is required to restart the motor. ▶ Error reset 445
	5 Activate DC braking	Trigger bit = 1: "DC braking" function activated. Trigger bit = 0: no action / deactivate function again. ▶ DC braking 145
	8 Run forward (CW)	Trigger bit = 0-1 edge: Motor is started in forward rotating direction (CW). Trigger bit = 1-0 edge: Motor is stopped again. Notes: • The stop method can be selected in 0x2838:003. • In the case of a bipolar setpoint selection (e.g ±10 V), the function is executed irrespective of the rotating direction. The rotating direction is determined by the sign of the setpoint. • The function also serves to realise an automatic start after switch-on. ▶ Start behavior 39 • The "Reverse rotational direction [13]" function can be used in connection with this function.

Address	Name / setting range / [default setting]		Information
	9	Run reverse (CCW)	Trigger bit = 0-1 edge: Motor is started in the reverse rotating direction (CCW). Trigger bit = 1-0 edge: Motor is stopped again. Notes: • The stop method can be selected in 0x2838:003. • In the case of a bipolar setpoint selection (e.g ±10 V), the function is executed irrespective of the rotating direction. The rotating direction is determined by the sign of the setpoint. • The function also serves to realise an automatic start after switch-on. ▶ Start behavior 📖 39 • The "Reverse rotational direction [13]" function can be used in connection with this function.
	13	Reverse rotational direction	Trigger bit = 1: the setpoint specified is inverted (i. e. the sign is inverted). Trigger bit = 0: no action / deactivate function again.
	17	Activate network setpoint	Trigger bit = 1: the network is used as setpoint source (if the trigger bit assigned has the highest setpoint priority). Trigger bit = 0: no action / deactivate function again.
	18	Activate preset (bit 0)	Selection bits for bit coded selection and activation of a parameterised setpoint (preset). ▶ Setpoint presets 📖 77
	19	Activate preset (bit 1)	
	20	Activate preset (bit 2)	
	21	Activate preset (bit 3)	
	39	Activate ramp 2	Trigger bit = 1: activate acceleration time 2 and deceleration time 2 manually. Trigger bit = 0: no action / deactivate function again. ▶ Ramp times 📖 76
	40	Load parameter set	Trigger bit = 0-1 edge: parameter change-over to the value set selected via "Select parameter set (bit 0)" and "Select parameter set (bit 1)". Trigger bit = 0: no action. Notes: • The activation method for the "Parameter change-over" function can be selected in 0x4046. ▶ Parameter change-over 📖 410
	41	Select parameter set (bit 0)	Selection bits for the "Parameter change-over" function. ▶ Parameter change-over 📖 410
	42	Select parameter set (bit 1)	
	43	Activate fault 1	Trigger bit = 1: Trigger user-defined error 1. Trigger bit = 0: no action. Notes: • After the error is triggered, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. Associated error code: • 25249 | 0x62A1 - Network: user fault 1
	44	Activate fault 2	Trigger bit = 1: Trigger user-defined error 2. Trigger bit = 0: no action. Notes: • After the error is triggered, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. Associated error code: • 25250 | 0x62A2 - Network: user fault 2
	45	Disable PID controlling	Trigger bit = 1: If PID control is activated, ignore PID control and drive the motor in speed-controlled manner. Trigger bit = 0: If PID control is activated, drive the motor with PID control. Notes: • The PID control can be activated in 0x4020:001. ▶ Configuring the process controller 📖 80



Address	Name / setting range / [default setting]	Information
	46 Set PID output to 0	Trigger bit = 1: If PID control is activated, I component and the output of the PID controller are set to 0 and the internal control algorithm is stopped. The PID control remains active. Trigger bit = 0: No action / deactivate function again. ▶ Configuring the process controller 80
	47 Inhibit PID I-component	Trigger bit = 1: If the PID control is activated, the I component of the PID controller is set to 0 and the integration process is stopped. Trigger bit = 0: No action / deactivate function again. ▶ Configuring the process controller 80
	48 Activate PID influence ramp	Trigger bit = 1: the influence of the process controller is shown by means of a ramp. Trigger bit = 0 or not connected: the influence of the process controller is shown by means of a ramp. Notes: • The influence of the process controller is always active (not only when PID control is activated). • Acceleration time for showing the influence of the process controller can be set in 0x404C:001. • Deceleration time for hiding the influence of the process controller can be set in 0x404C:002. ▶ Configuring the process controller 80
	49 Release holding brake	Trigger bit = 1: Release holding brake manually. Trigger bit = 0: No action. Notes: • The manually triggered "Release holding brake" command has a direct impact on the "Release holding brake [115]" trigger. Thus, the holding brake can be manually released if the power section is switched off. • The responsibility for a manual release of the holding brake has the external trigger source for the "Release holding brake" command. ▶ Holding brake control 152
	54 Position counter reset	Trigger bit = 1: Reset position counter manually. Trigger bit = 0: No action. ▶ Position counter 423
0x400E:002	NetWordIN1 function: Bit 1 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 1 of the mappable NetWordIN1 data word.
	0 Not active	Trigger bit without any function.
0x400E:003	NetWordIN1 function: Bit 2 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 2 of the mappable NetWordIN1 data word.
	3 Activate quick stop	Trigger bit = 1: "Quick stop" function activated. Trigger bit = 0: no action / deactivate function again. Notes: • The "Quick stop" function brings the motor to a standstill within the deceleration time set in 0x291C. • The "Quick stop" function has a higher priority than the "Run" function.
0x400E:004	NetWordIN1 function: Bit 3 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 3 of the mappable NetWordIN1 data word.
	0 Not active	Trigger bit without any function.

Address	Name / setting range / [default setting]	Information
0x400E:005	NetWordIN1 function: Bit 4 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 4 of the mappable NetWordIN1 data word.
	8 **Run forward (CW)**	Trigger bit = 0-1 edge: Motor is started in forward rotating direction (CW). Trigger bit = 1-0 edge: Motor is stopped again. Notes: • The stop method can be selected in 0x2838:003. • In the case of a bipolar setpoint selection (e.g ±10 V), the function is executed irrespective of the rotating direction. The rotating direction is determined by the sign of the setpoint. • The function also serves to realise an automatic start after switch-on. ▶ Start behavior 39 • The "Reverse rotational direction [13]" function can be used in connection with this function.
0x400E:006	NetWordIN1 function: Bit 5 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 5 of the mappable NetWordIN1 data word.
	18 **Activate preset (bit 0)**	Selection bits for bit coded selection and activation of a parameterised setpoint (preset). ▶ Setpoint presets 77
0x400E:007	NetWordIN1 function: Bit 6 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 6 of the mappable NetWordIN1 data word.
	19 **Activate preset (bit 1)**	Selection bits for bit coded selection and activation of a parameterised setpoint (preset). ▶ Setpoint presets 77
0x400E:008	NetWordIN1 function: Bit 7 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 7 of the mappable NetWordIN1 data word.
	4 **Reset error**	Trigger bit = 0-1 edge: Active error is reset (acknowledged) if the error condition is not active anymore and the error is resettable. Trigger bit = 0: No action. Notes: • After resetting the error, a new enable/start command is required to restart the motor. ▶ Error reset 445
0x400E:009	NetWordIN1 function: Bit 8 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 8 of the mappable NetWordIN1 data word.
	0 **Not active**	Trigger bit without any function.
0x400E:010	NetWordIN1 function: Bit 9 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260	Definition of the function that is to be triggered via bit 9 of the mappable NetWordIN1 data word.
	5 **Activate DC braking**	Trigger bit = 1: "DC braking" function activated. Trigger bit = 0: no action / deactivate function again. ▶ DC braking 145



Address	Name / setting range / [default setting]		Information
0x400E:011	NetWordIN1 function: Bit 10 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260		Definition of the function that is to be triggered via bit 10 of the mappable NetWordIN1 data word.
	0	**Not active**	Trigger bit without any function.
0x400E:012	NetWordIN1 function: Bit 11 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260		Definition of the function that is to be triggered via bit 11 of the mappable NetWordIN1 data word.
	0	**Not active**	Trigger bit without any function.
0x400E:013	NetWordIN1 function: Bit 12 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260		Definition of the function that is to be triggered via bit 12 of the mappable NetWordIN1 data word.
	13	**Reverse rotational direction**	Trigger bit = 1: the setpoint specified is inverted (i. e. the sign is inverted). Trigger bit = 0: no action / deactivate function again.
0x400E:014	NetWordIN1 function: Bit 13 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260		Definition of the function that is to be triggered via bit 13 of the mappable NetWordIN1 data word.
	0	**Not active**	Trigger bit without any function.
0x400E:015	NetWordIN1 function: Bit 14 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260		Definition of the function that is to be triggered via bit 14 of the mappable NetWordIN1 data word.
	0	**Not active**	Trigger bit without any function.
0x400E:016	NetWordIN1 function: Bit 15 • Setting can only be changed if the inverter is disabled. • For further possible settings, see parameter 0x400E:001. 260		Definition of the function that is to be triggered via bit 15 of the mappable NetWordIN1 data word.
	0	**Not active**	Trigger bit without any function.

12.2.4 Define your own status word format

The mappable data word NetWordOUT1 is available for implementing a separate status word format.

Details

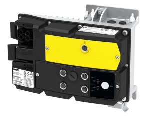
Designation	Parameter	Associated mapping entry *	Further information
NetWordOUT1	0x400A:001	0x400A0110	The triggers for bits 0 ... 15 of the NetWordOUT1 data word are defined in 0x2634:010 ... 0x2634:025.
* A mapping entry consists of index, subindex and data length in bits of the parameter to be mapped.			

General information about the process of data mapping can be found in the chapter of the same name for the corresponding network.

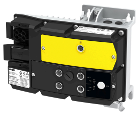
Parameter

Address	Name / setting range / [default setting]		Information
0x2634:010	Digital outputs function: NetWordOUT1 - bit 0		Assignment of a trigger to bit 0 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	0	Not connected	No trigger assigned (trigger is constantly FALSE).

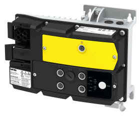
Address	Name / setting range / [default setting]		Information
	1	Constant TRUE	Trigger is constantly TRUE.
	11	Digital input 1	State of X3/DI1, taking an inversion set in 0x2632:001 into consideration.
	12	Digital input 2	State of X3/DI2, taking an inversion set in 0x2632:002 into consideration.
	13	Digital input 3	State of X3/DI3, taking an inversion set in 0x2632:003 into consideration.
	14	Digital input 4	State of X3/DI4, taking an inversion set in 0x2632:004 into consideration.
	15	Digital input 5	State of X3/DI5, taking an inversion set in 0x2632:005 into consideration.
	16	Digital input 6	State of X3/DI6, taking an inversion set in 0x2632:006 into consideration.
	17	Digital input 7	State of X3/DI7, taking an inversion set in 0x2632:007 into consideration.
	18	Digital input 8	State of X3/DI8, taking an inversion set in 0x2632:008 into consideration.
	30	NetWordIN1 - bit 12	State of NetWordIN1/bit 12 ... 15. • Display of NetWordIN1 in 0x4008:001. • For implementing an individual control word format, NetWordIN1 can be mapped to a process data input word.
	31	NetWordIN1 - bit 13	
	32	NetWordIN1 - bit 14	
	33	NetWordIN1 - bit 15	
	34	NetWordIN2 - bit 0	State of NetWordIN2/bit 0 ... bit 15. • Display of NetWordIN2 in 0x4008:002. • For controlling the digital outputs via network, NetWordIN2 can be mapped to a process data input word.
	35	NetWordIN2 - bit 1	
	36	NetWordIN2 - bit 2	
	37	NetWordIN2 - bit 3	
	38	NetWordIN2 - bit 4	
	39	NetWordIN2 - bit 5	
	40	NetWordIN2 - bit 6	
	41	NetWordIN2 - bit 7	
	42	NetWordIN2 - bit 8	
	43	NetWordIN2 - bit 9	
	44	NetWordIN2 - bit 10	
	45	NetWordIN2 - bit 11	
	46	NetWordIN2 - bit 12	
	47	NetWordIN2 - bit 13	
	48	NetWordIN2 - bit 14	
	49	NetWordIN2 - bit 15	
	50	Running	TRUE if inverter and start are enabled and output frequency > 0 Hz. Otherwise FALSE. Exception, quick stop mode: TRUE if inverter and start are enabled and output frequency > 0.2 Hz. Otherwise FALSE.
	51	**Ready for operation**	TRUE if inverter is ready for operation (no error active, no STO active and DC-bus voltage ok). Otherwise FALSE.
	52	Operation enabled	TRUE if inverter and start are enabled. Otherwise FALSE.
	53	Stop active	TRUE if inverter is enabled and motor is not started and output frequency = 0.
	54	Quick stop active	TRUE if quick stop is active. Otherwise FALSE.
	55	Inverter disabled (safety)	TRUE if the integrated safety system has inhibited the inverter. Otherwise FALSE. ▸ Safe torque off (STO) 📖 427
	56	Fault active	TRUE if error is active. Otherwise FALSE.
	57	Error (non-resettable) active	TRUE if non-resettable error is active. Otherwise FALSE.
	58	Device warning active	TRUE if warning is active. Otherwise FALSE. • A warning has no impact on the operating status of the inverter. • A warning is reset automatically if the cause has been eliminated.
	59	Device trouble active	TRUE if a fault is active. Otherwise FALSE. • In the event of a fault, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. • Exception: In case of a serious fault, the inverter is disabled immediately. The motor has no torque (coasts). • The error state will be left automatically if the error condition is not active anymore. • The restart behaviour after trouble can be configured. ▸ Automatic restart after a fault 📖 399



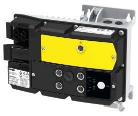
Address	Name / setting range / [default setting]		Information
	60	Heatsink temperature warning active	TRUE if current heatsink temperature > warning threshold for temperature monitoring. Otherwise FALSE. • Display of the current heatsink temperature in 0x2D84:001. • Setting of the warning threshold in 0x2D84:002.
	65	Motor PTC error active	TRUE if an error of the motor PTC has been detected. Otherwise FALSE. • The trigger is set irrespective of the response set in 0x2D49:002 when the motor temperature monitoring is triggered. ▶ Motor temperature monitoring 🕮 180
	66	Flying restart circuit active	TRUE if flying restart circuit active is active. Otherwise FALSE. ▶ Flying restart circuit 🕮 133
	67	DC braking active	TRUE if DC braking is active. Otherwise FALSE. ▶ DC braking 🕮 145
	68	Stop command active	TRUE if delay to standstill active. Otherwise FALSE.
	69	Rotational direction reversed	TRUE if output frequency is negative. Otherwise FALSE.
	70	Frequency threshold exceeded	TRUE if current output frequency > frequency threshold. Otherwise FALSE. • Display of the current output frequency in 0x2DDD. • Setting Frequency threshold in 0x4005. ▶ Trigger action if a frequency threshold is exceeded 🕮 421
	71	Actual speed = 0	TRUE if actual output frequency = 0 Hz (± 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD.
	72	Setpoint speed reached	TRUE if frequency setpoint reached. Otherwise FALSE.
	73	PID feedback = setpoint	TRUE if the controlled feedback variable = process controller setpoint (± in 0x404D:003 set hysteresis). Otherwise FALSE. ▶ Configuring the process controller🕮 80
	74	PID sleep mode active	TRUE if the inverter is in "PID sleep mode". Otherwise FALSE. ▶ Process controller sleep mode 🕮 87
	75	PID MIN alarm active	TRUE if feedback variable (with activated PID control) < MIN alarm threshold. Otherwise FALSE. • Setting of MIN alarm threshold in 0x404D:001. ▶ Configuring the process controller 🕮 80
	76	PID MAX alarm active	TRUE if the feedback variable (with activated PID control) > MAX alarm threshold. Otherwise FALSE. • Setting of MAX alarm threshold in 0x404D:002. ▶ Configuring the process controller 🕮 80
	77	PID MIN-MAX alarm active	TRUE if no PID alarm is active with activated PID control (MIN alarm threshold < feedback variable < MAX alarm threshold). Otherwise FALSE. • Setting of MIN alarm threshold in 0x404D:001. • Setting of MAX alarm threshold in 0x404D:002. ▶ Configuring the process controller 🕮 80
	78	Current limit reached	TRUE if current motor current ≥ maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88. • Setting for the maximum current in 0x6073.
	79	Torque limit reached	TRUE if torque limit has been reached or exceeded. Otherwise FALSE. • Setting "Actual positive torque limit" in 0x2949:003. • Setting "Actual negative torque limit" in 0x2949:004. ▶ Motor torque monitoring 🕮 184
	83	Load loss detected	TRUE if actual motor current < threshold for load loss detection after delay time of the load loss detection has elapsed. Otherwise FALSE. • Display of the actual current in 0x6078. • Setting Threshold in 0x4006:001. • Setting Delay time in 0x4006:002. ▶ Load loss detection 🕮 160
	84	Heavy load monitoring	TRUE if the actual apparent current of the motor exceeds the threshold for longer than the delay time. FALSE if the actual apparent current of the motor falls below the threshold value minus 5 % (hysteresis). ▶ Heavy load monitoring 🕮 187



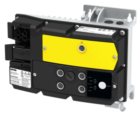
Address	Name / setting range / [default setting]		Information
	108	Parameter set 1 active	TRUE if parameter set 1 is loaded and active. Otherwise FALSE.
	109	Parameter set 2 active	TRUE if parameter set 2 is loaded and active. Otherwise FALSE.
	110	Parameter set 3 active	TRUE if parameter set 3 is loaded and active. Otherwise FALSE.
	111	Parameter set 4 active	TRUE if parameter set 4 is loaded and active. Otherwise FALSE.
	112	Parameter set load OK	TRUE after any parameter set has been loaded. Otherwise FALSE.
	113	Parameter set load fail	TRUE if any of the parameter sets could not be loaded. Otherwise FALSE.
	117	Motor phase failure	TRUE if a motor phase failure has been detected. Otherwise FALSE. Note! In the "SLSM-PSM" motor control mode, detection for motor phase failure is deactivated if HF injection is active in the low-speed range. ▶ Motor phase failure detection 182
	119	Holding brake released	TRUE, if holding brake is released. Otherwise FALSE. ▶ Holding brake control 152
	155	STO active	TRUE if the integrated safety system has triggered the "Safe torque off (STO)" function and if the safe inputs SIA and SIB = LOW (simultaneously). Otherwise FALSE. ▶ Safe torque off (STO) 427
	224	X3.1 IOL1 BI1 value	Binary values received via IO-Link corresponding to the binary input configuration for the respective IO-Link port. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▶ Configure function assignment 188 ▶ Configure IO-Link ports 205
	225	X3.1 IOL1 BI2 value	
	226	X3.1 IOL1 BI3 value	
	227	X3.1 IOL1 BI4 value	
	228	X3.1 IOL1 BI5 value	
	229	X3.1 IOL1 BI6 value	
	230	X3.1 IOL1 BI7 value	
	231	X3.1 IOL1 BI8 value	
	232	X3.2 IOL2 BI1 value	
	233	X3.2 IOL2 BI2 value	
	234	X3.2 IOL2 BI3 value	
	235	X3.2 IOL2 BI4 value	
	236	X3.2 IOL2 BI5 value	
	237	X3.2 IOL2 BI6 value	
	238	X3.2 IOL2 BI7 value	
	239	X3.2 IOL2 BI8 value	
	240	X3.3 IOL3 BI1 value	
	241	X3.3 IOL3 BI2 value	
	242	X3.3 IOL3 BI3 value	
	243	X3.3 IOL3 BI4 value	
	244	X3.3 IOL3 BI5 value	
	245	X3.3 IOL3 BI6 value	
	246	X3.3 IOL3 BI7 value	
	247	X3.3 IOL3 BI8 value	
	248	X3.4 IOL4 BI1 value	
	249	X3.4 IOL4 BI2 value	
	250	X3.4 IOL4 BI3 value	
	251	X3.4 IOL4 BI4 value	
	252	X3.4 IOL4 BI5 value	
	253	X3.4 IOL4 BI6 value	
	254	X3.4 IOL4 BI7 value	
	255	X3.4 IOL4 BI8 value	
0x2634:011	Digital outputs function: NetWordOUT1 - bit 1 • For further possible settings, see parameter 0x2634:010. 264		Assignment of a trigger to bit 1 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2634:012	Digital outputs function: NetWordOUT1 - bit 2 • For further possible settings, see parameter 0x2634:010. 264		Assignment of a trigger to bit 2 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	52	**Operation enabled**	TRUE if inverter and start are enabled. Otherwise FALSE.



Address	Name / setting range / [default setting]	Information
0x2634:013	Digital outputs function: NetWordOUT1 - bit 3 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 3 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	56 Fault active	TRUE if error is active. Otherwise FALSE.
0x2634:014	Digital outputs function: NetWordOUT1 - bit 4 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 4 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2634:015	Digital outputs function: NetWordOUT1 - bit 5 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 5 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	54 Quick stop active	TRUE if quick stop is active. Otherwise FALSE.
0x2634:016	Digital outputs function: NetWordOUT1 - bit 6 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 6 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	50 Running	TRUE if inverter and start are enabled and output frequency > 0 Hz. Otherwise FALSE. Exception, quick stop mode: TRUE if inverter and start are enabled and output frequency > 0.2 Hz. Otherwise FALSE.
0x2634:017	Digital outputs function: NetWordOUT1 - bit 7 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 7 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	58 Device warning active	TRUE if warning is active. Otherwise FALSE. • A warning has no impact on the operating status of the inverter. • A warning is reset automatically if the cause has been eliminated.
0x2634:018	Digital outputs function: NetWordOUT1 - bit 8 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 8 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2634:019	Digital outputs function: NetWordOUT1 - bit 9 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 9 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).
0x2634:020	Digital outputs function: NetWordOUT1 - bit 10 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 10 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	72 Setpoint speed reached	TRUE if frequency setpoint reached. Otherwise FALSE.
0x2634:021	Digital outputs function: NetWordOUT1 - bit 11 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 11 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	78 Current limit reached	TRUE if current motor current ≥ maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88. • Setting for the maximum current in 0x6073.
0x2634:022	Digital outputs function: NetWordOUT1 - bit 12 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 12 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	71 Actual speed = 0	TRUE if actual output frequency = 0 Hz (± 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD.
0x2634:023	Digital outputs function: NetWordOUT1 - bit 13 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 13 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	69 Rotational direction reversed	TRUE if output frequency is negative. Otherwise FALSE.
0x2634:024	Digital outputs function: NetWordOUT1 - bit 14 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 14 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	0 Not connected	No trigger assigned (trigger is constantly FALSE).



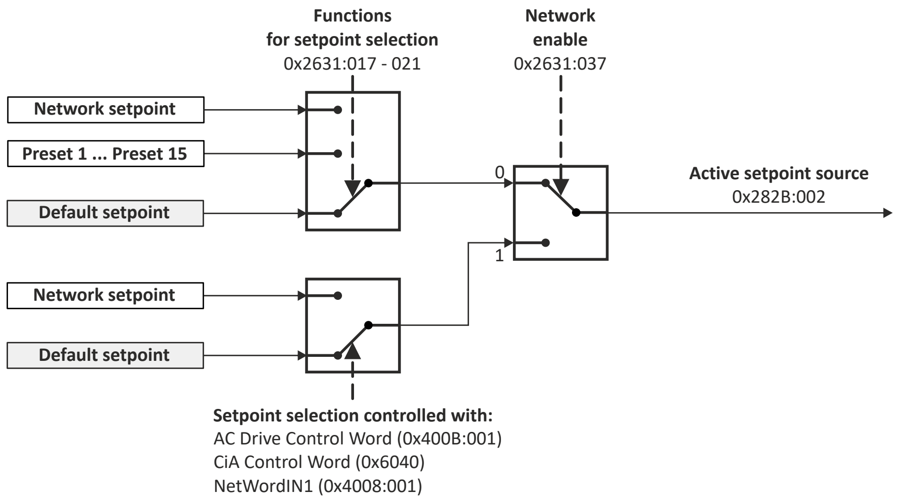
Address	Name / setting range / [default setting]	Information
0x2634:025	Digital outputs function: NetWordOUT1 - bit 15 • For further possible settings, see parameter 0x2634:010. 264	Assignment of a trigger to bit 15 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	55 **Inverter disabled (safety)**	TRUE if the integrated safety system has inhibited the inverter. Otherwise FALSE. ▶ Safe torque off (STO) 427
0x2635:010	Inversion of digital outputs: NetWordOUT1.00	Inversion of bit 0 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:011	Inversion of digital outputs: NetWordOUT1.01	Inversion of bit 1 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:012	Inversion of digital outputs: NetWordOUT1.02	Inversion of bit 2 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:013	Inversion of digital outputs: NetWordOUT1.03	Inversion of bit 3 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:014	Inversion of digital outputs: NetWordOUT1.04	Inversion of bit 4 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:015	Inversion of digital outputs: NetWordOUT1.05	Inversion of bit 5 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:016	Inversion of digital outputs: NetWordOUT1.06	Inversion of bit 6 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:017	Inversion of digital outputs: NetWordOUT1.07	Inversion of bit 7 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:018	Inversion of digital outputs: NetWordOUT1.08	Inversion of bit 8 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:019	Inversion of digital outputs: NetWordOUT1.09	Inversion of bit 9 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:020	Inversion of digital outputs: NetWordOUT1.10	Inversion of bit 10 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:021	Inversion of digital outputs: NetWordOUT1.11	Inversion of bit 11 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:022	Inversion of digital outputs: NetWordOUT1.12	Inversion of bit 12 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:023	Inversion of digital outputs: NetWordOUT1.13	Inversion of bit 13 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:024	Inversion of digital outputs: NetWordOUT1.14	Inversion of bit 14 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	
0x2635:025	Inversion of digital outputs: NetWordOUT1.15	Inversion of bit 15 of NetWordOUT1.
	0 **Not inverted**	
	1 Inverted	



Address	Name / setting range / [default setting]		Information
0x400A:001	Process output words: NetWordOUT1 • Read only		Mappable data word for the output of status messages of the inverter via network.
	Bit 0	Mapping bit 0	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:010
	Bit 1	Mapping bit 1	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:011
	Bit 2	Mapping bit 2	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:012
	Bit 3	Mapping bit 3	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:013
	Bit 4	Mapping bit 4	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:014
	Bit 5	Mapping bit 5	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:015
	Bit 6	Mapping bit 6	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:016
	Bit 7	Mapping bit 7	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:017
	Bit 8	Mapping bit 8	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:018
	Bit 9	Mapping bit 9	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:019
	Bit 10	Mapping bit 10	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:020
	Bit 11	Mapping bit 11	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:021
	Bit 12	Mapping bit 12	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:022
	Bit 13	Mapping bit 13	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:023
	Bit 14	Mapping bit 14	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:024
	Bit 15	Mapping bit 15	Mappable data word for the output of status messages of the inverter via network. Assignment of the status message: 0x2634:025

12.3 Define setpoint via network

The network setpoint must be explicitly selected if the setpoint is to be specified via the network.



▶ Option 1: Define network as standard setpoint source 📖 272
▶ Option 2: Change over to the network setpoint during operation 📖 272

Mappable parameters

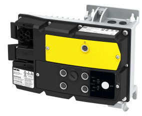
The following mappable parameter 0x400B:006 is available, among others, for specifying the setpoint.

Parameter

Address	Name / setting range / [default setting]	Information
0x400B:006	Process input data: Velocity mode setpoint -1000.0 ... [**0.0**] ... 1000.0 Hz	Mappable parameter for defining the setpoint for operating mode "MS: Velocity mode" via network. • If this parameter is to be used as standard setpoint source, the selection "Network [5]" must be set in 0x2860:001. • If this bipolar setpoint is used, the direction of rotation cannot be controlled via the network control word. The direction of rotation is determined by the sign of the setpoint.
0x400B:007	Process input data: PID setpoint -300.00 ... [**0.00**] ... 300.00 PID unit	Mappable parameter for defining the setpoint for the PID control via network. • If this parameter is to be used as standard setpoint source, the selection "Network [5]" must be set in 0x2860:002.
0x400B:008	Process input data: Torque mode setpoint -32768 ... [**0**] ... 32767 Nm	Mappable parameter for defining the setpoint for operating mode "MS: Torque mode" via network. • If this parameter is to be used as standard setpoint source, the selection "Network [5]" must be set in 0x2860:003. • The scaling factor can be set in 0x400B:009. • Scaled torque setpoint = torque setpoint (0x400B:008) / $2^{\text{scaling factor}}$ Example: • Torque setpoint (0x400B:008) = 345 [Nm] • Scaling factor (0x400B:009) = 3 • Scaled torque setpoint = 345 [Nm] / 2^3 = 43.125 [Nm]

In addition, further mappable parameters with different resolutions are available for the transmission of the frequency setpoint and actual frequency values.

▶ Mappable parameters for exchanging setpoints and actual values 📖 273



12.3.1 Option 1: Define network as standard setpoint source

If the setpoint is to be specified exclusively via the network, the network for the corresponding control can be simply set as the standard setpoint source.

- Setting for the frequency control: 0x2860:001 = "Network [5]".

12.3.2 Option 2: Change over to the network setpoint during operation

There are several options for change-over to the network setpoint.

Example 1: Independent of the network used, a change-over from the standard setpoint source to the network setpoint is to be possible via a digital trigger (e. g. digital input).

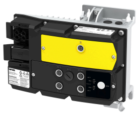
1. Set a standard setpoint source different than "Network [5]" in 0x2860:001.
2. Set the desired digital trigger (e. g. digital input) in via which the change-over to the network setpoint is to take place.

The current setpoint source is shown in 0x282B:002.

The setpoint change-over by means of the network control words is only possible if the controller is activated via the network 0x2631:037.

The following table describes the change-over to the network setpoint via the different network control words:

<table>
<tr><th>Network control word</th><th colspan="2">Change-over to network setpoint</th></tr>
<tr><td rowspan="4">NetWordIN1 data word
0x4008:001</td><td colspan="2">Assign the function "Activate network setpoint [17]" to the bit that is to be used for activating the network setpoint.
• The functions that are to be triggered via bits 0 ... 15 of the NetWordIN1 data word are defined in 0x400E:001 ... 0x400E:016.</td></tr>
<tr><td>Bit x</td><td>Selection:</td></tr>
<tr><td>0</td><td>Standard setpoint source selected in 0x2860:001.</td></tr>
<tr><td>1</td><td>Network setpoint</td></tr>
<tr><td rowspan="5">AC drive control word
0x400B:001</td><td colspan="2">The network setpoint is activated via bit 6 of the AC Drive control word:</td></tr>
<tr><td>Bit 6</td><td>Selection:</td></tr>
<tr><td>0</td><td>Standard setpoint source selected in 0x2860:001.</td></tr>
<tr><td>1</td><td>Network setpoint</td></tr>
<tr><td colspan="2">In order that the activation via bit 6 works, "Activate network control" bit 5 must be TRUE. (Standard)!
If control is to be initiated via bit 6 without "Activate network control" bit 5, the selection "Network setpoint active [116]" must be set in 0x2631:017.</td></tr>
<tr><td>CiA control word
0x6040</td><td colspan="2">In case of control via the device profile CiA 402:
• In operating mode "CiA: Velocity mode (vl) [2]", the setpoint speed defined via the "Set speed" 0x6042 parameter is used.
• A changeover to an alternative setpoint source via the CiA control word is not possible.</td></tr>
</table>



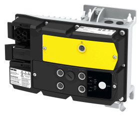
12.3.3 Mappable parameters for exchanging setpoints and actual values

The parameters listed in the following can also be mapped to network registers, in order to transfer set points and actual values via the network.

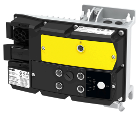
- The parameters are always available irrespective of the network option.
- Several parameters with different resolutions are available for selection to transfer the frequency setpoint and actual value.
- The use of these parameters for the transmission of process data is optional. It is also possible to use only a selection of the parameters.

Parameter

Address	Name / setting range / [default setting]	Information
0x400B:003	Process input data: Network setpoint frequency (0.1) 0.0 ... [**0.0**] ... 1000.0 Hz	Mappable parameter for specifying the frequency setpoint in [0.1 Hz] via network. • The specification is made without sign (irrespective of the rotating direction). • The rotating direction is specified via the control word. • Example: 456 = 45.6 Hz
0x400B:004	Process input data: Network setpoint speed 0 ... [**0**] ... 65535 rpm	Mappable parameter for specifying the setpoint as speed in [rpm] via network. • The specification is made without sign (irrespective of the rotating direction). • The rotating direction is specified via the control word. • Example: 456 ≡ 456 rpm
0x400B:005	Process input data: Network setpoint frequency (0.01) 0.00 ... [**0.00**] ... 655.35 Hz	Mappable parameter for specifying the frequency setpoint in [0.01 Hz] via network. • The specification is made without sign (irrespective of the rotating direction). • The rotating direction is specified via the control word. • Example: 456 = 4.56 Hz
0x400B:009	Process input data: Torque scaling -128 ... [**0**] ... 127	Scaling factor for torque setpoint 0x400B:008 and actual torque value 0x400C:007 via network. • With the setting 0, no scaling takes place. Example: • Scaled actual torque value (0x400C:007) = 345 [Nm] • Scaling factor (0x400B:009) = 3 • Actual torque value = 345 [Nm] / 23 = 43.125 [Nm]
0x400B:013	Process input data: Network frequency setpoint [+/-16384] -16384 ... [**0**] ... 16384	Mappable parameter for specifying the frequency setpoint via network. • ±16384 = ±100 % Maximum frequency 0x2916
0x400C:003	Process output data: Frequency (0.1) • Read only: x.x Hz	Mappable parameter for the output of the actual frequency value in [0.1 Hz] via network. • The output is effected without sign (irrespective of the rotating direction). • The rotating direction is specified via the status word. • Example: 456 = 45.6 Hz
0x400C:004	Process output data: Motor speed • Read only: x rpm	Mappable parameter for the output of the actual value as speed in [rpm] via network. • The output is made without sign (irrespective of the rotating direction). • The rotating direction is specified via the status word. • Example: 456 ≡ 456 rpm
0x400C:006	Process output data: Frequency (0.01) • Read only: x.xx Hz	Mappable parameter for the output of the actual frequency value in [0.01 Hz] via network. • The output is made without sign (irrespective of the rotating direction). • The rotating direction is specified via the status word. • Example: 456 = 4.56 Hz



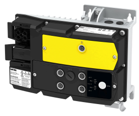
Address	Name / setting range / [default setting]	Information
0x400C:007	Process output data: Torque scaled • Read only	Mappable parameter for the output of the actual torque value in [Nm / $2^{\text{scaling factor}}$] via network. • The scaling factor can be set in 0x400B:009. • Actual torque value = scaled actual torque value (0x400C:007) / $2^{\text{scaling factor}}$ Example: • Scaled actual torque value (0x400C:007) = 345 [Nm] • Scaling factor (0x400B:009) = 3 • Actual torque value = 345 [Nm] / 2^3 = 43.125 [Nm]
0x400C:009	Process output data: Frequency [+/-16384] • Read only	Mappable parameter for the output of the actual frequency value via network. • ±16384 = ±100 % Maximum frequency 0x2916



12.4 Further mappable parameters

The parameters listed in the following can also be mapped to network registers to transmit, for example, control and status information as process data or to control outputs of the inverter via the network.

- The parameters are always available irrespective of the network option.
- The use of these parameters for the transmission of process data is optional. It is also possible to use only a selection of the parameters.



12.4.1 Process input data

12.4.1.1 Feedback of PID variable via network

Parameter

Address	Name / setting range / [default setting]	Information
0x400B:011	Process input data: PID feedback -300.00 ... [**0.00**] ... 300.00 PID unit	Mappable parameter for the feedback of the variable (actual value) via network. • Only effective with the selection "Network[5]" in 0x4020:002.

12.4.1.2 Control digital outputs via network

The mappable data word NetWordIN2 is available for controlling the digital outputs via the network.

Parameter

Address	Name / setting range / [default setting]		Information
0x4008:002	Process input words: NetWordIN2 0x0000 ... [**0x0000**] ... 0xFFFF		Mappable data word for optional control of the digital outputs via network. Assignment of the digital outputs: • Digital output 1: 0x2634:002 / selection [34] ... [49]
	Bit 0	Mapping bit 0	
	Bit 1	Mapping bit 1	
	Bit 2	Mapping bit 2	
	Bit 3	Mapping bit 3	
	Bit 4	Mapping bit 4	
	Bit 5	Mapping bit 5	
	Bit 6	Mapping bit 6	
	Bit 7	Mapping bit 7	
	Bit 8	Mapping bit 8	
	Bit 9	Mapping bit 9	
	Bit 10	Mapping bit 10	
	Bit 11	Mapping bit 11	
	Bit 12	Mapping bit 12	
	Bit 13	Mapping bit 13	
	Bit 14	Mapping bit 14	
	Bit 15	Mapping bit 15	

Related topics

▸ Configure digital outputs 🕮 194

12.4.1.3 Additive voltage impression via network

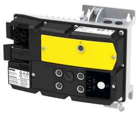
The mappable data word NetWordIN5 is available for the optional specification of an additive voltage setpoint via the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x4008:005	Process input words: NetWordIN5 -100.0 ... [**0.0**] ... 100.0 %	Mappable data word for optionally specifying an additive voltage setpoint via network. • 100 % = Rated voltage 0x2C01:007 • This value is used if "Network [3]" is selected in 0x2B13:002.

Related topics

▸ Additive voltage impression 🕮 135

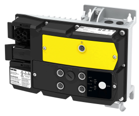


12.4.2 Process output data

12.4.2.1 Drive status

Parameter

Address	Name / setting range / [default setting]		Information
0x400C:005	Process output data: Drive status • Read only		Mappable status word (Modbus Legacy Register 2003).
	0	Error (non-resettable) active	
	1	Fault active	
	2	Waiting for start	
	4	Inverter disabled	
	5	Stop active	
	7	Identification active	
	8	Running	
	9	Acceleration active	
	10	Deceleration active	
	11	Deceleration override active	
	12	DC braking active	
	13	Flying start active	
	14	Current limit reached	



12.5 Process data handling in the event of error

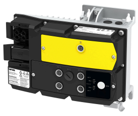
Received invalid process data is not used. The inverter uses the last valid process data received. You can optionally set that the contents of the process data in the inverter are set to the value "0" after invalid process data has been received.

The setting in 0x24E5:001 is independent of the response selected in 0x2859:005 if invalid process data has been received!

If the application requires that the drive keeps moving with the last valid process data when receiving invalid process data, set the response "No response" or "Warning" in 0x2859:005. In addition, the selection "Clear data [1]" must not be set in 0x24E5:001. Deleting the process data would stop the motor.

Parameter

Address	Name / setting range / [default setting]		Information
0x24E5:001	Process data handling in case of error: Procedure		Selection which process data the inverter is to use after receiving invalid process data.
	0	**Keep last data**	The last valid process data of the master are used.
	1	Clear data	The contents of the process data in the inverter is set to the value "0".
	2	Reset control word	The RUN command is reset. All other parameters keep their current value. All control words linked via the PDO mappings are set to 0.



12.6 Suppress certain alarm / emergency messages to the master

To simplify the error handling between a master and the inverter, a function for suppressing diagnostic or alarm messages is implemented. If desired, the user can suppress the display of alarm responses in the master.

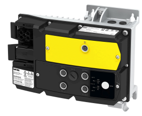
Usually, all errors occurring in the device are reported to a connected PLC if an alarm / emergency mechanism with the connected communication system is supported. In order to suppress certain alarm / emergency messages, this filter mechanism selects the error messages that shall not be reported to the PLC.

In object 0x285C, the corresponding error numbers are given in n subindex. Up to n = 10 error numbers can be selected.

If the "0xFFFFFFFF" error code is found in one of the subindices, all messages are blocked.

Parameter

Address	Name / setting range / [default setting]	Information
0x285C:001	Alarm supression: Entry 1 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	Definition of error numbers that shall not be sent as alarm, emergency, or diagnostic message to the connected master. "0xFFFFFFFF"= suppression of all messages to the master.
0x285C:002	Alarm supression: Entry 2 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:003	Alarm supression: Entry 3 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:004	Alarm supression: Entry 4 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:005	Alarm supression: Entry 5 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:006	Alarm supression: Entry 6 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:007	Alarm supression: Entry 7 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:008	Alarm supression: Entry 8 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:009	Alarm supression: Entry 9 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	
0x285C:010	Alarm supression: Entry 10 0x00000000 ... [**0x00000000**] ... 0xFFFFFFFF	



12.7 CiA 402 device profile

The CiA® 402 device profile defines the functional behaviour of stepping motors, servo drives, and frequency inverters. In order to be able to describe the different drive types, various operating modes and device parameters are specified in the device profile. Each operating mode provides objects (e.g. for the setpoint speed, acceleration and deceleration) to generate the desired drive behaviour.

- CiA® is a registered community trademark of the CAN in Automation e. V user organization.
- More information can be found in the CiA 402 specification (CANopen device profile for drives and Motion Control) of the CAN in Automation (CiA) user organization: http://www.can-cia.org

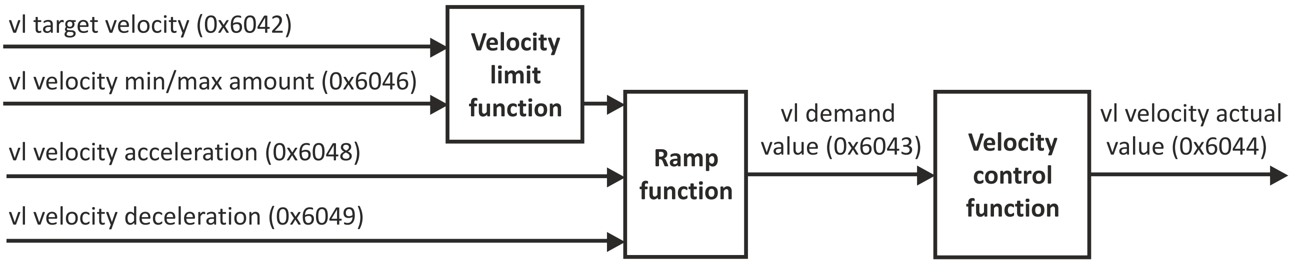
12.7.1 Supported operating modes

Details

In the following, the steps required for configuring the operating mode "CiA: Velocity mode (vl)" are described.

1. Set the operating mode "CiA: Velocity mode (vl) [2]" in 0x6060.
2. Set speed is specified via the parameter "Set speed" 0x6042.
3. Process input data and process output data are available for the control in the CiA402.

The following signal flow shows the internal setpoint logics:



The "CiA: Velocity mode (vl)" operating mode is now active and the inverter reacts to the setpoint speed specified via the network.

The inverter only supports the CiA 402 operating mode "CiA: Velocity mode (vl)".

Parameter

Address	Name / setting range / [default setting]		Information
0x6060	CiA: Operation mode • Setting can only be changed if the inverter is disabled.		CiA: Operation mode
	-2	**MS: Velocity mode**	Vendor specific velocity mode ▸ Configuring the frequency control 📖 73
	-1	MS: Torque mode	Vendor specific torque mode • Only possible in motor control type 0x2C00 = "Sensorless vector control (SLVC) [4]" or "Servo control (SC ASM) [2]". ▸ Configuring the torque control 📖 97
	0	No selection	No selection
	2	CiA: Velocity mode (vl)	CiA: Velocity mode ▸ CiA 402 device profile 📖 280
0x6061	CiA: Active operation mode • Read only		CiA: Active operation mode
	-11	Identification	
	-10	Test mode	
	-2	MS: Velocity mode	Vendor specific velocity mode
	-1	MS: Torque mode	Manufacturer-specific torque mode
	0	No selection	No selection
	2	CiA: Velocity mode (vl)	CiA: Velocity mode

12.7.2 Basic setting

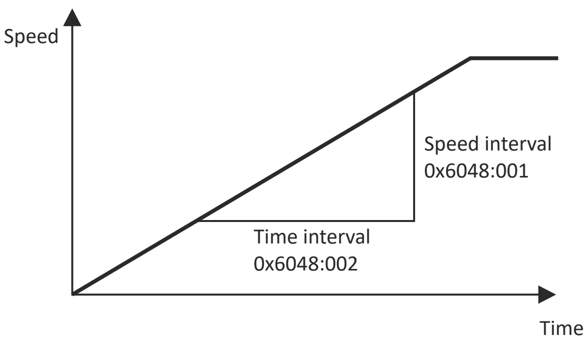
Set the following parameters.

Parameter

Address	Name / setting range / [default setting]		Information
0x605A	CiA: Quick stop mode		Device status after exiting the quick stop ramp. • Setting is only effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]".
	2	**Ramp > switch on disabled**	Automatic change to the "Switch-on inhibited" device state. • The "Quick stop active [54]" status is reset to FALSE after ramp-down to standstill.
	6	Ramp > quick stop active	The inverter remains in the "Quick stop active" device state. • The "Quick stop active [54]" status remains TRUE until the "Quick stop" function is activated.
0x605B	Shutdown option code		Defines the transition from the status "Operation enabled" to "Ready to start".
	0	**Disable drive function**	0: Immediate inverter disable (standard setting)
	1	Slow down on quick stop ramp and disable drive function	1: "Quick stop" with subsequent inverter disable.
0x6085	Quick stop deceleration 0 ... [**546000**] ... 2147483647 inc/s²		Change in velocity used for deceleration to a standstill if quick stop is activated. • Setting is only effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]". • In operating mode 0x6060 = "MS: Velocity mode [-2]", the deceleration time set in 0x291C is effective. • Setting is only effective in the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]". 0x6085 = (initial speed of the motor [rpm] / duration of the ramp until standstill [s]) * 1092

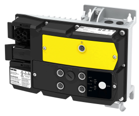
12.7.3 Process input data

The following diagram demonstrates the relationship of the parameters 0x6048:001 and 0x6048:002.



Parameter

Address	Name / setting range / [default setting]	Information
0x6042	Set speed -32768 ... [**0**] ... 32767 rpm	Set speed (velocity mode).
0x6046:001	Speed limits: Min. speed 0 ... [**0**] ... 480000 rpm	Min. speed (velocity mode).
0x6046:002	Speed limits: Max. speed 0 ... [**2147483647**] ... 2147483647 rpm	Max. speed (velocity mode).
0x6048:001	Acceleration ramp: CiA acceleration: Delta speed 0 ... [**3000**] ... 2147483647 rpm	CiA acceleration: Delta speed
0x6048:002	Acceleration ramp: CiA acceleration: Delta time 0 ... [**10**] ... 65535 s	CiA acceleration: Delta time



Address	Name / setting range / [default setting]	Information
0x6049:001	Deceleration ramp: CiA deceleration: Delta speed 0 ... [**3000**] ... 2147483647 rpm	CiA deceleration: Delta speed
0x6049:002	Deceleration ramp: CiA deceleration: Delta time 0 ... [**10**] ... 65535 s	CiA deceleration: Delta time
0x6071	Set torque -3276.8 ... [**0.0**] ... 3276.7 %	Setting of the setpoint torque for the torque operating modes. • 100 % = Rated motor torque 0x6076 The inverter does not support the CiA 402 torque mode.

12.7.4 Process output data

Parameter

Address	Name / setting range / [default setting]	Information
0x6043	Internal set speed • Read only: x rpm	Display of the internal set speed (velocity demand).
0x6044	Actual speed • Read only: x rpm	Display of the actual speed (velocity mode).
0x6074	Internal set torque • Read only: x.x %	Display of the internal set torque. • 100 % = Rated motor torque 0x6076

12.7.5 Commands for device state control

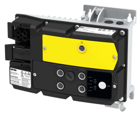
0x6040 (CiA control word) can be used to trigger commands to put the inverter into a certain device state.

Command	Bit pattern in the CiA control word (0x6040)							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Reset fault	Dependent on the operating mode			Operation enable	Activating quick stop	Establish readiness for operation	Switch-on
Switch-off 📖 285	0	X	X	X	X	1	1	0
Switch on 📖 286	0	X	X	X	0	1	1	1
Enable operation 📖 287	0	X	X	X	1	1	1	1
Activate quick stop 📖 288	0	X	X	X	X	0	1	X
Disable operation 📖 289	0	X	X	X	0	1	1	1
Pulse inhibit 📖 290	0	X	X	X	X	X	0	X
Reset fault 📖 291	0↗1	X	X	X	X	X	X	X
X = state is not relevant								

More Lenze-specific control bits (bit 8 ... 15)

Command	Bit pattern in the CiA control word (0x6040)							
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Reserved	Release brake	Reserved	Dependent on the operating mode				Stop motor
Apply brake	X	0	X	X	X	X	X	X
Release brake	X	1	X	X	X	X	X	X
Stop motor	X	X	X	X	X	X	X	1
X = state is not relevant								

Detailed information on the various commands can be found in the following sections.



Parameter

Address	Name / setting range / [default setting]		Information
0x6040	CiA control word 0 ... **[0]** ... 65535		Mappable CiA control word with bit assignment according to device profile CiA 402.
	Bit 0	Switch on	1 = switch-on
	Bit 1	Enable voltage	1 = Enable voltage
	Bit 2	Disable quick stop	0 = activate quick stop
	Bit 3	Enable operation	1 = Enable operation
	Bit 4	Operation mode specific	Operation mode specific
	Bit 5	Operation mode specific	
	Bit 6	Operation mode specific	
	Bit 7	Fault reset	0-1 edge = fault reset
	Bit 8	Halt	1 = stop motor (ramping down to frequency setpoint 0 Hz)
	Bit 9	Operation mode specific	Operating mode specific
	Bit 10	Reserved	
	Bit 11	Override coast	
	Bit 12	AutoInit	
	Bit 13	Reserved	
	Bit 14	Release holding brake	1 = release holding brake ⚠ CAUTION! • The manually triggered "Release holding brake" command has a direct impact on the "Release holding brake [115]" trigger. Thus, the holding brake can be manually released if the power section is switched off. • The responsibility for a manual opening of the holding brake lies with the user of the external trigger source for the "Release holding brake" command. ▸ Holding brake control 📖 152
	Bit 15	Reserved	

Example

A PLC program of a PLCopen control can, for instance, trigger several commands for state changes in a row by the level change at the *bRegulatorOn* input of the "MC_Power" block.

In the mentioned example, these device commands are "Switch-off" and "Switch on" in this order.

12.7.5.1 Switch-off

This command serves to change the "Switch-on inhibited" device state to the "Ready to switch on" device state.

If the pulse inhibit has already been deactivated and the device status of the inverter is "Operation enabled", this command sets the pulse inhibit again.

- If automatic brake operation is activated, the parameterized Brake closing time (0x2820:002) is observed: The system waits until the brake is applied before the pulse inhibit is set. In the CiA 402 "CiA: Velocity mode", the Brake closing time is not observed.
- The motor has no torque.
- The device state "Switched on" or "Operation enabled" changes back to the "Ready to switch on" state.

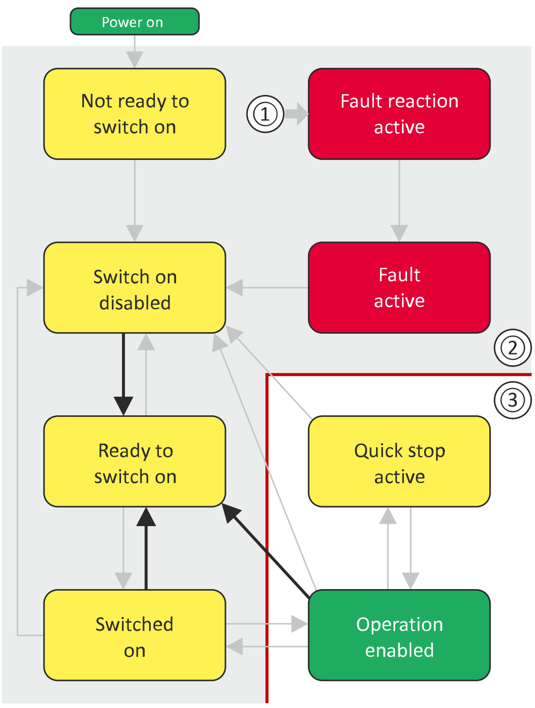
⚠ DANGER!

Uncontrolled motor movements by pulse inhibit.

If the motor has no torque, a load that is connected to motors without a holding brake may cause uncontrolled movements! Without a load, the motor will coast.

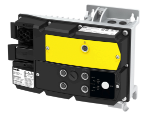
Possible consequences: Death or severe injuries

► Only operate the inverter under permissible load conditions.



1 From all states
2 Power section disabled (pulse inhibit)
3 Power section enabled

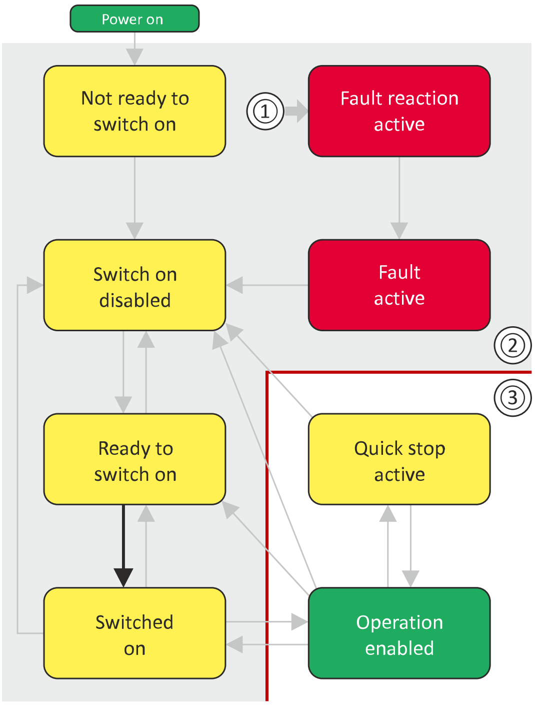
Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Reset fault**	**Operating mode dependent**			**Operation enabled**	**Activate quick stop**	**Establish readiness for operation**	**Switch-on**
X	0	X	X	X	X	1	1	0
X = state is not relevant								



12.7.5.2 Switch on

This command serves to deactivate the switch on inhibit which is active after switch on or after the reset (acknowledgement) of an error.

A changeover to the "Switched on" device status takes place.



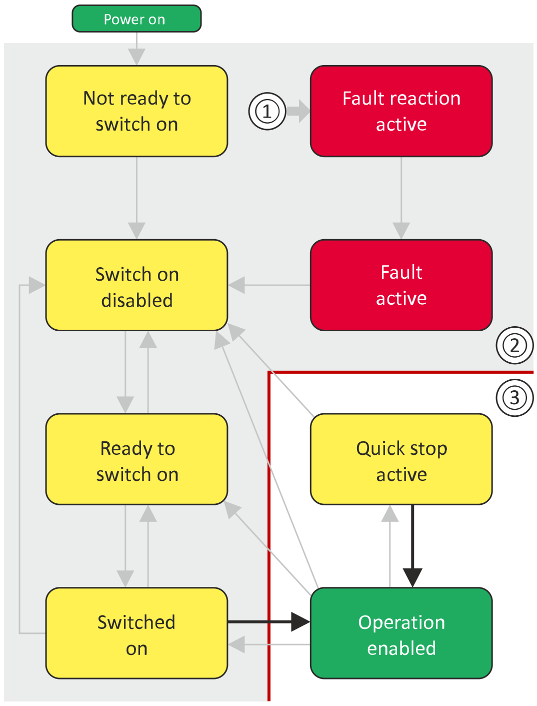
1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Reset fault	Operating mode-dependent			Operation enabled	Activate quick stop	Establish readiness for operation	Switch-on
X	0	X	X	X	0	1	1	1
X = state is not relevant								

12.7.5.3 Enable operation

This command enables the operation and stop an active quick stop again.

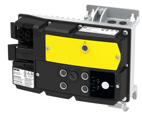
- A changeover to the "Operation enabled" device status takes place.
- The output stages of the inverter become active.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Reset fault	Operating mode dependent			Operation enabled	Activate quick stop	Establish readiness for operation	Switch-on
X	0	X	X	X	1	1	1	1
X = state is not relevant								

If the device status "Operation enabled" is signalled in the CiA status word, the inverter is ready to accept set points from the network master.

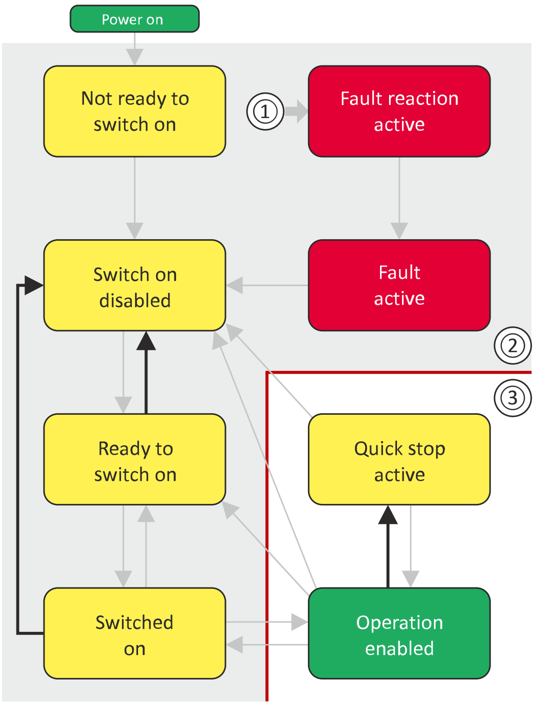


12.7.5.4 Activate quick stop

This command activates quick stop when the operation is enabled.

- The drive is brought to a standstill irrespective of the setpoint specified with the deceleration (0x6085) set for quick stop.
- A changeover to the "Quick stop active" device status takes place.
- Then, state change to "Switch-on inhibited" parameter 0x605A "CiA: Quick stop mode".

If the operation is not enabled (device state "Ready to switch on" or "Switched on"), this command changes the state to "operation disabled".



1 From all states
2 Power section disabled (pulse inhibit)
3 Power section enabled

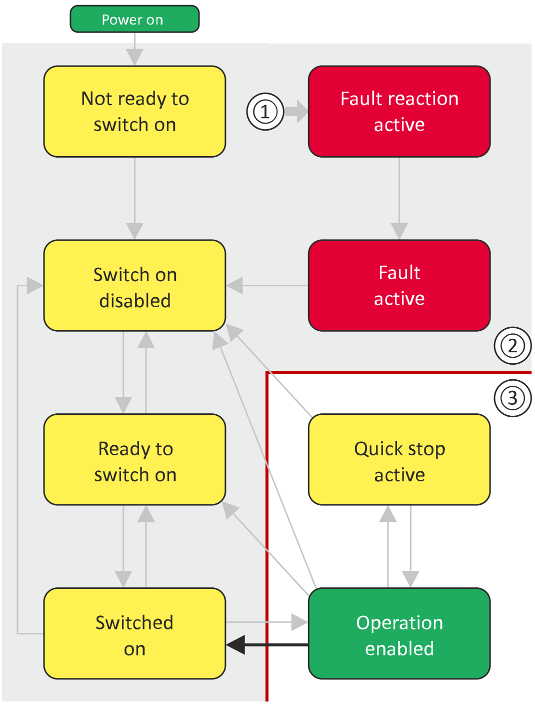
Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Reset fault**	**Operating mode dependent**			**Operation enabled**	**Activate quick stop**	**Establish readiness for operation**	**Switch-on**
X	0	X	X	X	X	0	1	X
X = state is not relevant								

- During quick stop, the inverter executes the setpoint generation and no longer follows the setpoint defined by the network master.
- If several inverters execute a chained synchronous motion, the quick stop function has to be coordinated by the network master by means of a quick stop profile (master function). In this case, quick stop cannot be activated via the control bit 2.
- During the quick stop, the maximum current (0x6073) and the maximum torque (0x6072) are active. The lower of the two limits determines the motor torque output. The torque limits from 0x60E0 and 0x60E1 are not effective during the quick stop.

12.7.5.5 Disable operation

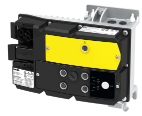
This command disables the enabled operation again.

- The pulse inhibit is set (pulses of the inverter are inhibited).
- If automatic brake operation is activated, the parameterized Brake closing time (0x2820:002) is observed: The system waits until the brake is applied before the pulse inhibit is set. In the CiA 402 "CiA: Velocity mode", the Brake closing time is not observed.
- A changeover to the "Switched on" device state takes place.



1 From all states
2 Power section disabled (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Reset fault**	**Operating mode dependent**			**Operation enabled**	**Activate quick stop**	**Establish readiness for operation**	**Switch-on**
X	0	X	X	X	0	1	1	1
X = state is not relevant								



12.7.5.6 Pulse inhibit

This command disables the output stages of the inverter.

- The pulse inhibit is activated (pulses of the inverter are inhibited) if not already active.
- The motor has no torque.
- A changeover to the "Switch-on inhibited" device state takes place.

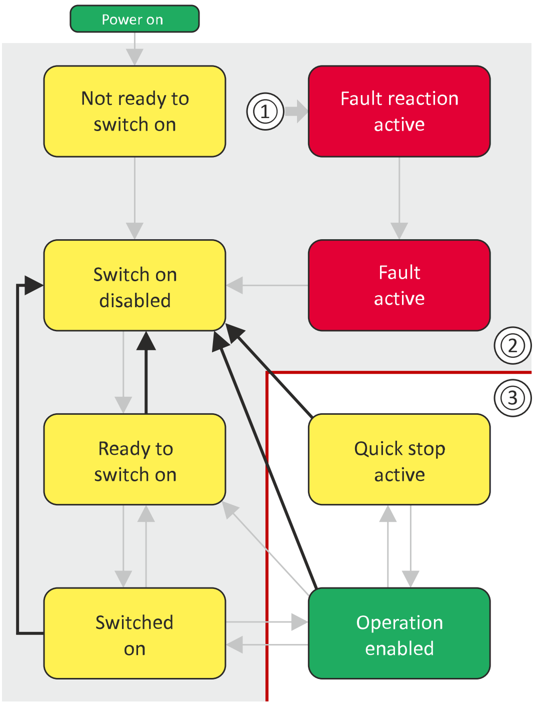
⚠ DANGER!

Uncontrolled motor movements by pulse inhibit.

If the motor has no torque, a load that is connected to motors without a holding brake may cause uncontrolled movements! Without a load, the motor will coast.

Possible consequences: Death or severe injuries

▶ Only operate the inverter under permissible load conditions.



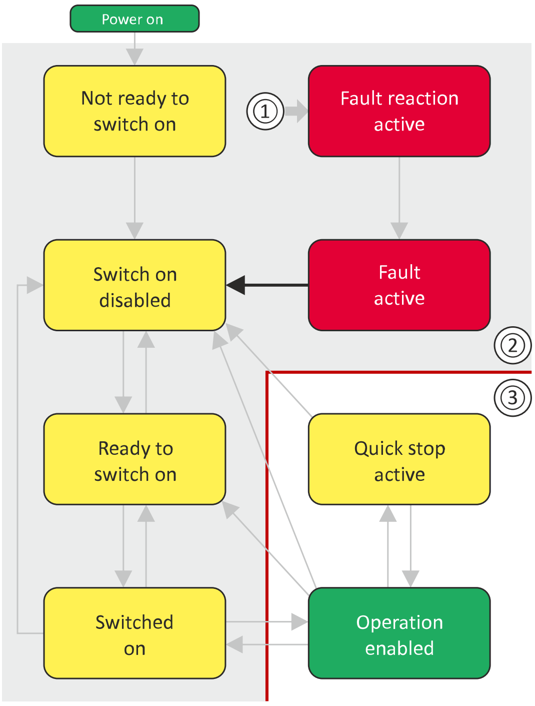
1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Reset fault**	**Operating mode dependent**			**Operation enabled**	**Activate quick stop**	**Establish readiness for operation**	**Switch-on**
X	0	X	X	X	X	X	0	X
X = state is not relevant								

12.7.5.7 Reset fault

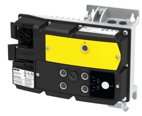
This command resets a pending fault if the cause of the fault has been eliminated.

- The pulse inhibit remains active (pulses of the inverter are inhibited).
- A changeover to the "Switch-on inhibited" device status takes place (switch-on inhibit remains active).



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA control word (0x6040)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Reset fault**	**Operating mode dependent**			**Operation enabled**	**Activating quick stop**	**Establish readiness for operation**	**Switch-on**
X	0↗1	X	X	X	X	X	X	X
X = state is not relevant								



12.7.6 Device states

0x6041 (CiA status word) displays the current device status of the inverter.

Status bit 7: "Warning active"

Status bit 7 indicates a warning.

- A warning does **not** cause a state change.
- Warnings do not need to be reset.

More Lenze-specific status bits (bit 8 ... 15)

Device status	Bit pattern in the CiA status word (0x6041)							
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	STO (Safe Torque Off) Not active	Brake released	Reserved	Reserved	Internal limitation is active	Target position reached	Control word processed successfully	RPDOs deactivated
Brake applied	X	0	0	0	X	X	X	X
Brake released	X	1	0	0	X	X	X	X
STO (Safe Torque Off) active	0	X	0	0	X	X	X	X
STO (Safe Torque Off) not active	1	X	0	0	X	X	X	X
X = state is not relevant								

Detailed information on the various device states can be found in the following sections.

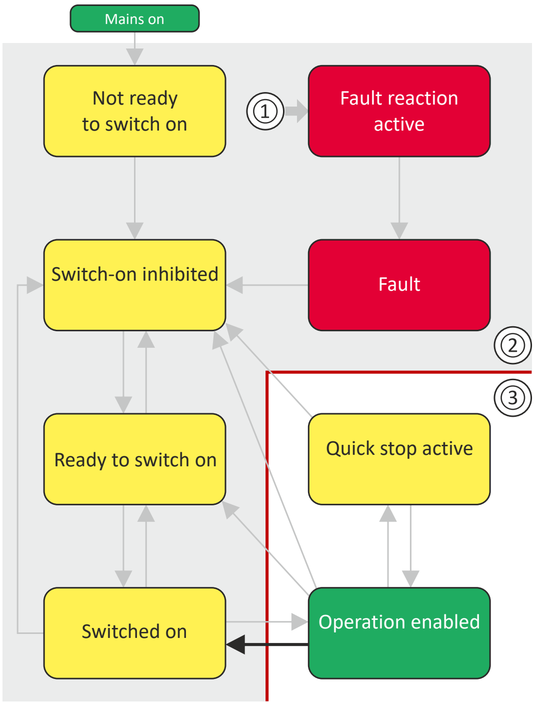
Parameter

Address	Name / setting range / [default setting]		Information
0x6041	CiA status word • Read only		Mappable CiA status word with bit assignment according to device profile CiA 402.
	Bit 0	Ready to switch on	1 = drive ready to start
	Bit 1	Switched on	1 = drive switched-on
	Bit 2	Operation enabled	1 = operation enabled
	Bit 3	Fault	1 = fault or trouble active
	Bit 4	Voltage enabled	1 = DC bus ready for operation
	Bit 5	Quick stop disabled	0 = quick stop active
	Bit 6	Switch on disabled	1 = operation inhibited
	Bit 7	Warning	1 = warning active
	Bit 9	CiA control enabled	1 = inverter can receive commands via network. • Bit is not set in the operating mode 0x6060 = "MS: Velocity mode [-2]".
	Bit 10	Setpoint reached	1 = the actual speed is in the window.
	Bit 11	Internal limit active	1 = internal limitation of a setpoint active
	Bit 12	Operation mode specific	1 = operation enabled and no test mode activated. (no internal setpoint generation active.)
	Bit 14	Holding brake released	1 = holding brake released
	Bit 15	STO not active	0 = STO is active or impermissible state at the safe inputs SIA and SIB (inverter disabled) 1 = STO is not active (inverter enabled)

12.7.6.1 Not ready to switch on

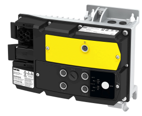
This is the device state of the inverter directly after switching on the supply voltage.

- In this device status, the device is initialised.
- Communication is not possible yet.
- The inverter cannot be parameterised yet and no device commands can be carried out yet.
- The motor brake, if available, is closed.
- Operation is inhibited.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation inhibited**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	0	X	X	0	0	0	0
X = state is not relevant								

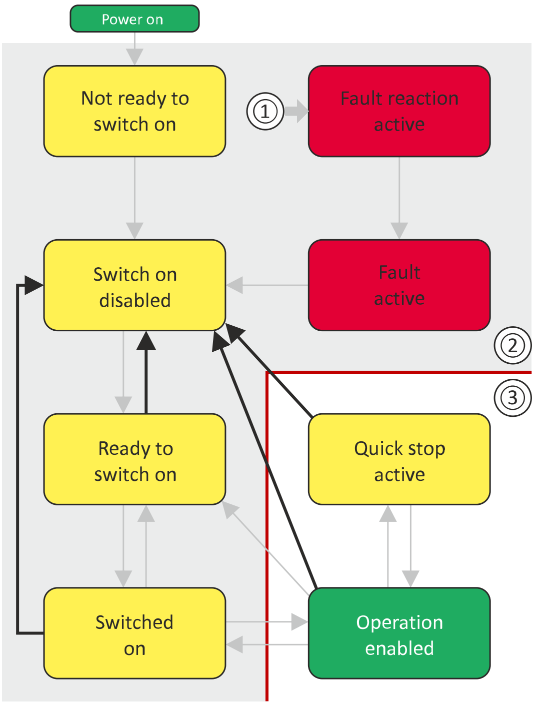


12.7.6.2 Switch-on inhibited

This is the device state of the inverter after the device has been initialised successfully.

A change to this state also takes place when the EtherCAT bus is in "Operational" state or the PDO communication via (Control selection) is deactivated.

- Process data monitoring is active.
- Communication is possible.
- The DC-bus voltage can be present.
- The inverter can be parameterised.
- If the internal holding brake control (0x2820:001) is active in the inverter, the motor brake is closed.
- Operation is inhibited.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

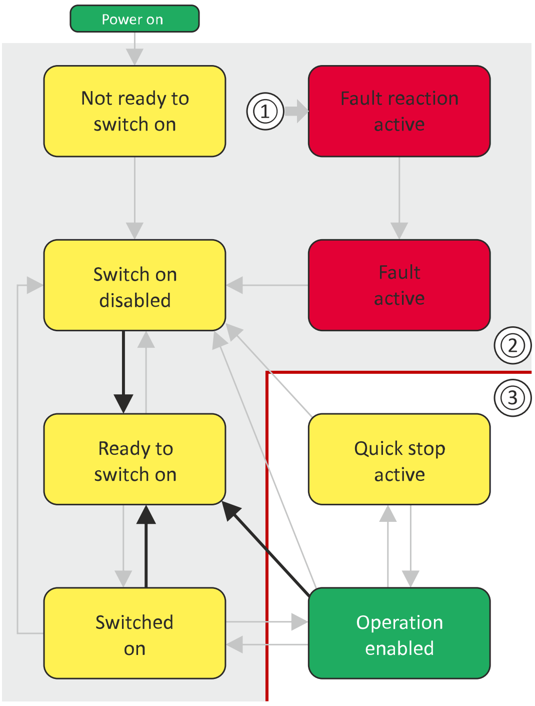
Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation inhibited**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	1	X	X	0	0	0	0
X = state is not relevant								

12.7.6.3 Ready to switch on

This is the device state of the inverter after the device has been initialised successfully and after the Switch-off command has been triggered.

A change to this device state also takes place if the "Switch-off" command was triggered in the states "Switched on" or "Enable operation".

- Process data monitoring is active.
- Communication is possible.
- The DC-bus voltage is available.
- The inverter can be parameterised.
- If the internal holding brake control (0x2820:001) is active in the inverter, the motor brake is closed.
- Operation is inhibited.



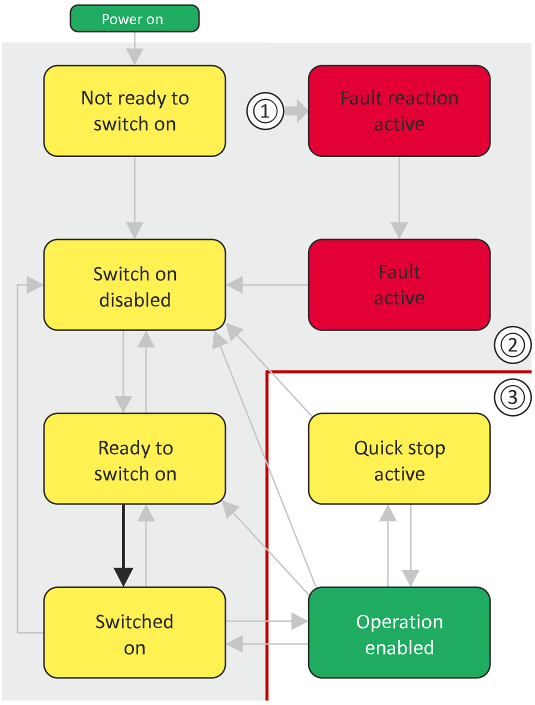
1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation inhibited**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	0	1	X	0	0	0	1
X = state is not relevant								

12.7.6.4 Switched on

This is the device state of the inverter after the "Switch on" command has been triggered in the "Ready to switch on" device state.

- Process data monitoring is active.
- Communication is possible.
- The DC-bus voltage is available.
- The inverter can be parameterized.
- If the internal holding brake control (0x2820:001) is active in the inverter, the motor brake is closed.
- Operation is disabled.



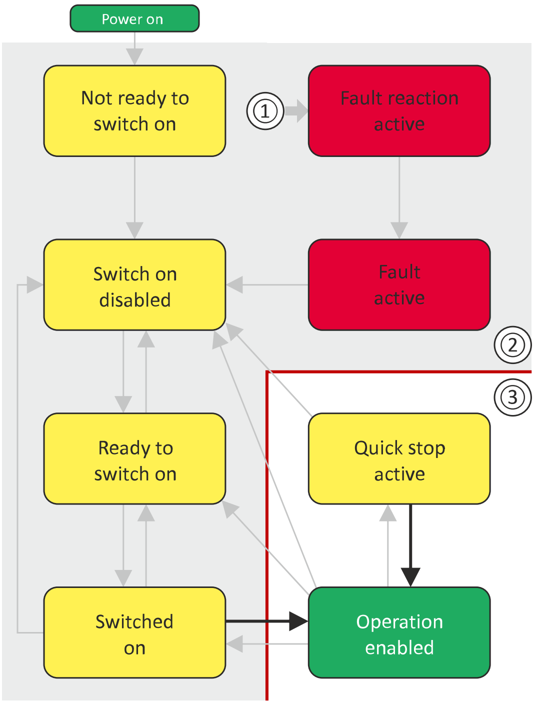
1 From all states
2 Power section disabled (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation disabled**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	0	1	X	0	0	1	1
X = stateis not relevant								

12.7.6.5 Operation enabled

This device state represents normal operation. Operation in the selected operating mode is enabled and no errors have occurred.

- Only the parameters of the inverter can be changed that do not require an inverter disable.
- A motor brake, if any, is open if the automatic operation of the holding brake control is activated (0x2820:001 = 0).
- The drive control is active.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

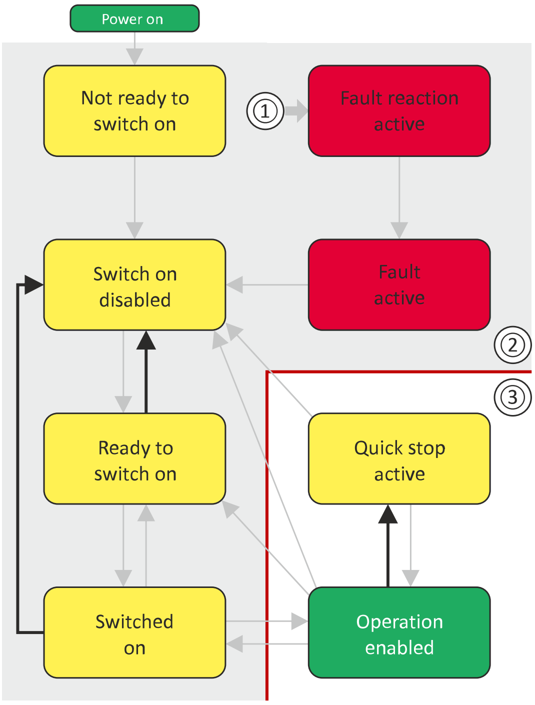
Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation inhibited**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	0	1	X	0	1	1	1
X = state is not relevant								

If the device status "Operation enabled" is signalled in the CiA status word, the inverter is ready to accept set points from the network master.

12.7.6.6 Quick stop active

This device state is active if quick stop is executed or active.

- Only the parameters of the inverter can be changed that do not require an inverter disable.
- If the internal holding brake control (0x2820:001) is active in the inverter, the motor brake is closed.
- The drive control is active.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation inhibited**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	0	0	X	0	1	1	1
X = state is not relevant								

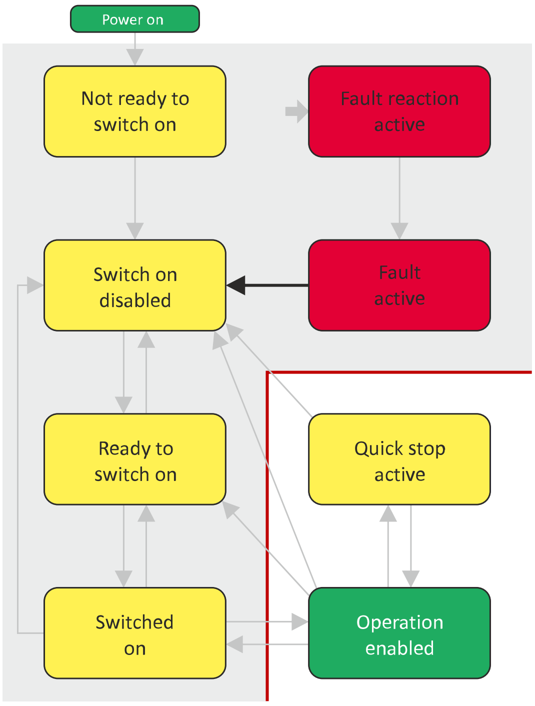
The "Enable operation" command stops an active quick stop.

12.7.6.7 Fault reaction active

This device state becomes active if a minor fault occurs. This means that the inverter is still able to drive the motor in a controlled way.

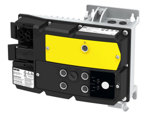
- The inverter is brought to a standstill irrespective of the setpoint specified with the deceleration (0x6085) set for quick stop.

  If the inverter is at standstill, a change to the "Trouble" device state take place automatically.
- Only the parameters of the inverter can be changed that do not require an inverter disable.
- If the internal holding brake control (0x2820:001) is active in the inverter, the motor brake is closed.
- The drive control is active.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

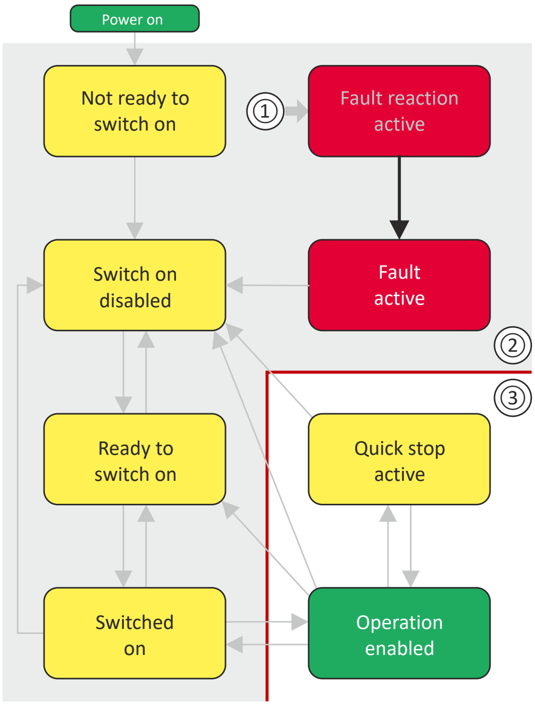
Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Warning active	Operation inhibited	Quick stop active	DC bus ready for operation	Fault active	Operation enabled	Switched on	Ready to switch on
X	X	0	X	X	1	1	1	1
X = state is not relevant								



12.7.6.8 Trouble

This device state becomes active if a serious system fault occurs. This means that the inverter is no longer able to drive the motor in a controlled way. The inverter is switched off immediately.

- The pulse inhibit is active (pulses of the inverter are inhibited).
- The motor is torqueless.
- The motor brake, if available, is closed.
- Operation is inhibited.
- The inverter can be parameterised.



1 From all states
2 Power section inhibited (pulse inhibit)
3 Power section enabled

Bit pattern in the CiA status word (0x6041)								
Bit 15 ... 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved (specific)	**Warning active**	**Operation inhibited**	**Quick stop active**	**DC bus ready for operation**	**Fault active**	**Operation enabled**	**Switched on**	**Ready to switch on**
X	X	0	X	X	1	0	0	0
X = state is not relevant								

This device state can only be left with the "Reset fault" command if the cause of the fault has been removed.

12.7.6.9 STO (Safe Torque Off)

The status of the STO activity is included in bit 15 of the CiA status word (0x6041).

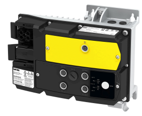
This status information is required since the activation of STO causes all integral control parts to be deleted.

In case of hoists, for instance, the inverter would be sagging without any corrective measures after completing STO.

In order to prevent this unwanted state, the control has to be preloaded with a starting value after completing STO:

- In case of a control type with encoder, the integral-action component of the speed controller must be preloaded.
- In case of V/f characteristic control for asynchronous motor (VFC closed loop), the slip frequency must be preloaded.

If STO is inhibited, a changeover to the "Ready to switch on" device state takes place and a warning is output.



12.8 AC drive

For control via the AC drive profile, the parameters listed in the following can be mapped to network registers.

- Mapping entry for the AC Drive control word (0x400B:001): 0x400B0110
- Mapping entry for the AC Drive status word (0x400C:001): 0x400C0110
- Detailed information on the data mapping can be found in the chapter of the corresponding network.

12.8.1 AC drive control word

The AC drive control word (0x400B:001) will only be processed if the network control in 0x2631:037 has been activated and the network is also active as the control source.

▶ Changing the control source during operation 🕮 71

Moreover, some bits in the control word are ignored if the bit 5 "Activate network control" is not set. For details see the parameter description for 0x400B:001.

The following logic applies to bit 0 "Run forward (CW)" and bit 1 "Run reverse (CCW)":

Bit 0 "Run forward (CW)"	Bit 1 "Run reverse (CCW)"	Action
0	0	Stopping with stop method set in 0x2838:003.
0↗1 (edge)	0	Run forward (CW)
0	0↗1 (edge)	Run reverse (CCW)
0↗1 (edge)	0↗1 (edge)	No action / last action is continued to be executed.
1	1	
1	0	
0	1	
1↘0 (edge)	1	Run reverse (CCW)
1	1↘0 (edge)	Run forward (CW)

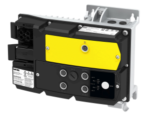
Parameter

Address	Name / setting range / [default setting]		Information
0x400B:001	Process input data: AC Drive control word 0 ... **[0]** ... 65535		Mappable control word with bit assignment in compliance with EtherNet/IP™ AC drive profile.
	Bit 0	Run forward (CW)	Bits are only evaluated if bit 5 = "1". For the exact logic, see the above truth table.
	Bit 1	Run reverse (CCW)	
	Bit 2	Reset error (0-1 edge)	
	Bit 5	Activate network control	If bit 5 = "1" and 0x2631:037 = "Network control active [114]": All bits of the AC Drive control word are evaluated. If bit 5 = "0" or 0x2631:037 = "Not connected [0]": • Bit 0, 1, 6, 12, 13, 14, 15 of the AC drive control word are not evaluated (ignored). • Active control source is the "Flexible I/O configuration". ▶ Changing the control source during operation 🕮 71
	Bit 6	Activate network setpoint	0 = the standard setpoint source selected in 0x2860:001 is used. 1 = network setpoint is used. Bit 6 is only evaluated if bit 5 = "1". For control without bit 5, the "Network setpoint active [116]" selection must be set in 0x2631:017.
	Bit 12	Disable inverter	Bits are only evaluated if bit 5 = "1".
	Bit 13	Activate quick stop	
	Bit 14	Disable PID controlling	
	Bit 15	Activate DC braking	

12.8.2 AC drive status word

Parameter

<table>
<tr><th>Address</th><th colspan="2">Name / setting range / [default setting]</th><th>Information</th></tr>
<tr><td rowspan="17">0x400C:001</td><td colspan="2">Process output data: AC Drive status word
• Read only</td><td>Mappable status word with bit assignment in compliance with EtherNet/IP™ AC drive profile.</td></tr>
<tr><td>Bit 0</td><td>Fault/Trip active</td><td rowspan="8"></td></tr>
<tr><td>Bit 1</td><td>Warning active</td></tr>
<tr><td>Bit 2</td><td>Running forward</td></tr>
<tr><td>Bit 3</td><td>Running reverse</td></tr>
<tr><td>Bit 4</td><td>Ready</td></tr>
<tr><td>Bit 5</td><td>Network control active</td></tr>
<tr><td>Bit 6</td><td>Network setpoint active</td></tr>
<tr><td>Bit 7</td><td>At Reference</td></tr>
<tr><td>Bit 8</td><td>Profile-State bit 0</td><td rowspan="4">The drive status is coded as follows:
0: Manufacturer-specific (reserved)
1: Startup (drive initialisation)
2: Not_Ready (mains voltage switched off)
3: Ready (mains voltage switched on)
4: Enabled (drive has received run command)
5: Stopping (drive has received stop command and is stopped)
6: Fault_Stop (drive is stopped due to a fault)
7: Faulted (faults have occurred)</td></tr>
<tr><td>Bit 9</td><td>Profile-State bit 1</td></tr>
<tr><td>Bit 10</td><td>Profile-State bit 2</td></tr>
<tr><td>Bit 11</td><td>Profile-State bit 3</td></tr>
<tr><td>Bit 12</td><td>Process controller active</td><td rowspan="4"></td></tr>
<tr><td>Bit 13</td><td>Torque mode active</td></tr>
<tr><td>Bit 14</td><td>Current limit reached</td></tr>
<tr><td>Bit 15</td><td>DC braking active</td></tr>
</table>



12.9 EtherCAT

EtherCAT® (Ethernet for Controller and Automation Technology) is an Ethernet-based fieldbus system which fulfils the application profile for industrial realtime systems.

- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- Detailed information on EtherCAT can be found on the web page of EtherCAT Technology Group (ETG): http://www.ethercat.org
- Information about the sizing of an EtherCAT network can be found in the configuration document.

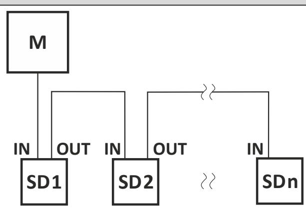
Prerequisites:

- In 0x231F:005 the network selection is set to "EtherCAT".
- For commissioning, load the current device description files for Lenze EtherCAT devices via the "Package Manager" onto your engineering PC.

EtherCAT connection

The connection is made via the M12 connectors **X396** (IN) and **X397** (OUT).

Typical topology

Line


M	Master
SD	Slave Device

12.9.1 Commissioning

In the following, the required steps are described to control the device with an EtherCAT master.

Preconditions

- The inverter is networked as EtherCAT slave to an EtherCAT master and, if necessary, further EtherCAT devices.
- The entire wiring has already been checked for completeness, short circuit and earth fault.
- All EtherCAT devices are supplied with voltage and are switched on.
- An Engineering PC with installed »PLC Designer« is connected to the master.
  - Download »PLC Designer«
- A »PLC Designer« project with current device description files for EtherCAT is available.
  - Download XML/ESI files for Lenze devices
  - The files are installed via the device repository of the »PLC Designer« (menu command "Tools → Device repository").

Holding brake

The holding brake must be activated via the CiA control word (0x6040).

1. Set the brake mode to manual in the "Overview / advanced - motor brake control set" mask.

The holding brake can now be released via bit 14 of the CiA control word.

DC-injection brake

The DC-injection brake must be activated via the NetWordIn1 interface. The **L_MC1P_BasicActuatingSpeed** function block can be used to definitively trigger the brake, whereby the wLControlword property is available. This property corresponds to the NetwordIN1 parameter.

A further configuration of the DC-injection brake itself can be undertaken with the usual device parameters. Change the other parameters of the axis if necessary.

▶ Holding brake control 📖 152

▶ DC braking 📖 145

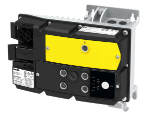
Details

- When using the »PLC Designers«, the CiA 402 operating mode "CiA: Velocity mode (vl)" is automatically activated.
- In the operating mode "CiA: Velocity mode (vl)", the set speed defined via the "Set speed" (0x6042) parameter is used.
- A changeover to an alternative setpoint source via 0x6040 (CiA control word) is not possible.
- 0x6040 (CiA control word) serves to start/stop the EtherCAT device.
- Further information:

▶ Process input data (CiA 402 objects) 📖 106

▶ Process output data (CiA 402 objects) 📖 107

▶ CiA 402 device profile 📖 280

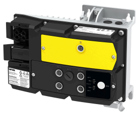


Commissioning steps

How to configure the network:

In the default setting, the digital input DI1 is assigned the "Run" function. If the network control is activated, this function serves as "start enable" for start commands via network. Hence, the digital input DI1 must be set to the HIGH level in order that the motor can be started via the network.

▶ Flexible I/O configuration of the start, stop and rotating direction commands 52



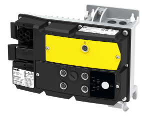
1. **Configure gateway function of the master**
   1. Start »PLC Designer«.
   2. Open or recreate a »PLC Designer« project.
   3. Open the "Communication settings" tab of the master.
   4. Click "Add gateway".

      Do the following in the appearing dialog window:

      a) Enter the IP address of the master.

      b) Confirm the entry with "OK".
   5. Click "Search network".
   6. Select the corresponding master for the previously entered IP address.
   7. Click "Set active path".
   8. Log into the master using the "Online → Log in" menu command or with <Alt>+<F8>.
      Now you can access the slaves from the Engineering PC via the EtherCAT master as gateway.
2. **Carry out network scan**
   1. Execute the "Start Search" command in the context menu of the master.
      The appearing dialog box lists all available EtherCAT devices according to the physical order in the network.
   2. Click "Copy all devices into the project".
      The physical network structure is reproduced in the »PLC Designer« project.

A proper operation requires that the network topology generated in the project corresponds to the physical order of the EtherCAT nodes in the network. Otherwise, an error message displays which slave (product code) is to be expected at which position.



3. **Integrate L_MC1P_BasicActuatingSpeed functional module**
   1. Open the PLC program code (PLC_PRG).
   2. Open the **Input Help** in the lower input area by right clicking via the context menu.
   3. Open the category ***Function blocks***.
   4. Select the element ***L_MC1_P → L_MC1_P_MotionControlBasic → 1_POUs → PLCopenAdditional*** and then the function block ***L_MC1P_BasicActuatingSpeed***. Click OK.
   5. Enter a variable name in the "Declare variables" dialog box.
   6. Close the dialog box by clicking on the ***OK*** button.

      The ***L_MC1P_BasicActuatingSpeed*** function block together with its data structure is now integrated in the PLC program code.
   7. Open the ***L_MC1P_BasicActuatingSpeed*** function block and set the reference to the axis data structure (Axis:=i550_Motion_Axis).

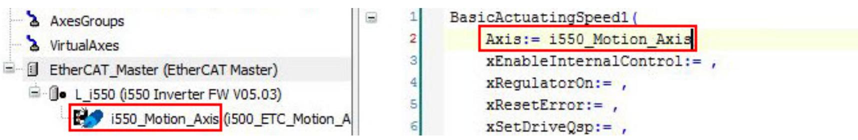


Fig. 5: Assign axis

   8. Open the Application context menu in the device tree for ***Application***, select the command ***Add object → Visualization ...*** and insert the visualization of the function block.
   9. Insert a frame into the visualzation using the ***Frame tool*** (Basic tab).
   10. To the frame visualization, add the function block ***L_MC1P_BasicActuatingSpeed*** and close the dialog box by clicking the ***OK*** button.
   11. Under ***Properties***, select the reference of the function block with which the visualization should be linked.

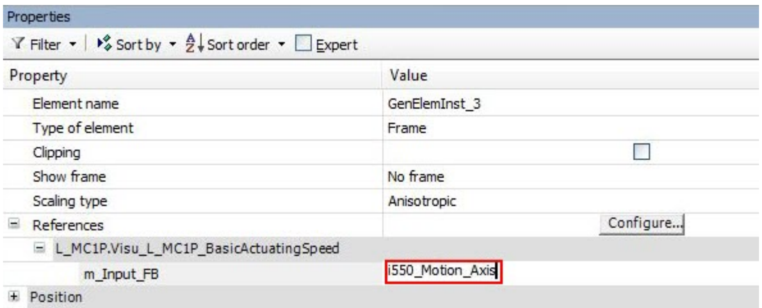


Fig. 6: Select reference

4. **Adapt EtherCAT device to the application**
   1. Select the axis movement of the i550.

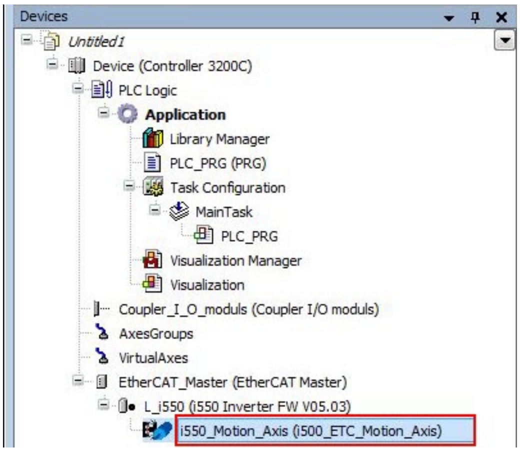


Fig. 7: Select i550

   2. In case of "Switch on axis", select ***Simple [0]*** for the use of the axis L_MC1P_BasicActuatingSpeed.
   3. The following parameters need to be configured:

      a) Modes of operation 0x6060 = "CiA: Velocity mode [2]"

      b) Function list: Start 0x2631:002 = "Constant TRUE [1]"
5. **Adjust the parameter values of the inverter**
   1. Adapt parameter values under the "Settings" and "Parameter list" tabs.
   2. Set the PDO mapping under the “Process data” tab.
   3. Assign variable names under the "EtherCAT I/O image" by double-clicking the variable fields.
6. **Load the network configuration into the master**
   1. Log off: Menu command "Online → Log off" or <Ctrl>+<F8>.
   2. Compiling: Menu command "Build → Build" or <F11>.
   3. Log in: Menu command "Online → Log in" or <Alt>+<F8>.
      The configuration, the parameter settings and the PLC program are loaded into the master. Afterwards, all EtherCAT slaves are initialized.

These steps must be carried out after each change within the »PLC Designer« project. An already available configuration and an available PLC program in the master will then be overwritten.

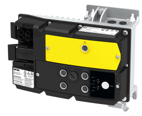
Restart of the communication

The communication needs to be restarted after the EtherCAT configuration is changed, so that the changed settings can take effect.

For restarting communication, there are two options:

a) Switch inverter off and on again.

b) 0x2360 Set = "Restart with current values [1]".



Parameter

Address	Name / setting range / [default setting]	Information
0x2360	EtherCAT communication	Restart communication. • When the device command has been executed successfully, the value 0 is shown.
	0 No action/no error	Only status feedback
	1 Restart with current values	Execute command
	10 In process	Only status feedback
	11 Action cancelled	
	12 Fault	

12.9.2 Basic setting and options

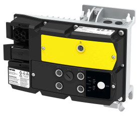
Addressing of the EtherCAT devices

The EtherCAT devices are normally addressed via a permanent 16-bit address defined by the master. At the start, this address is assigned automatically to each node by the master, depending on the physical order in the network. The address is not saved and gets lost when the device is switched off.

As an alternative, a master can also use station alias addresses of the slaves that are configured and *unambiguous* in the network. For this purpose, a station alias address must be saved in the EEPROM of the device by setting the corresponding register.

Parameter

Address	Name / setting range / [default setting]	Information
0x2361:004	EtherCAT settings: Device identifier 0 ... [**0**] ... 65535	Setting of the identifier *unambiguous* in the network (Explicit Device Identification).



12.9.3 Process data transfer

- Process data is cyclically transferred between the EtherCAT master and the slaves (permanent exchange of current input and output data).
- The transfer of process data is time-critical.
- The process data serve to control the EtherCAT slaves.
- The process data can be directly accessed by the master. The data in the PLC, for instance, are directly stored in the I/O area.
- The contents of the process data are defined via I/O Data mapping (definition of the EtherCAT objects that are to be transmitted cyclically).
- Process data is not saved in the device.
- Process data is, e. g. setpoints, actual values, control and status words.

Configuration

- The available objects can be mapped in the CiA 402 operating mode "CiA: Velocity mode (vl)" (0x6060 = 2) and as dynamic (free) configuration. The contents can be selected from all mappable objects.
  - Standard mapping objects for the CiA 402 operating mode "CiA: Velocity mode (vl)":
    ▶ Standard mapping 📖 311
  - Mapping objects for a dynamic (free) assignment:
- Mapping is executed in the master configuration and automatically transferred to the slave.
- The data format is 0xAAAABBCC (AAAA = index, BB = subindex, CC = length).

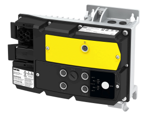
12.9.3.1 Standard mapping

Standard mapping of the RPDOs in the CiA 402 operating mode "CiA: Velocity mode (vl)"

Master → slave	
RPDO mapping entry 1 (CiA: Velocity mode (vl))	CiA control word (0x6040)
RPDO mapping entry 2 (CiA: Velocity mode (vl))	CiA 402 parameter "Set speed" (0x6042)
RPDO mapping Entry 1 (freely configurable)	Not assigned.

Standard mapping of the TPDOs in the CiA 402 operating mode "CiA: Velocity mode (vl)"

Slave → master	
TPDO mapping entry 1 (CiA: Velocity mode (vl))	CiA status word (0x6041)
TPDO mapping entry 2 (CiA: Velocity mode (vl))	CiA 402 parameter "Actual speed" (0x6044)
TPDO mapping entry 3 (CiA: Velocity mode (vl))	Error code (0x603F)
TPDO mapping entry 1 (freely configurable)	Digital inputs



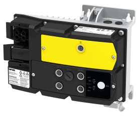
12.9.4 Parameter data transfer

- For configuring and diagnosing the EtherCAT devices, the parameters are accessed by means of acyclic communication.
- Parameter data is transferred as SDOs (Service Data Objects).
- The SDO services enable the writing and reading access to parameters, EtherCAT objects and CiA 402 objects.
  - Process input data 281
  - Process output data 282
- The transfer of parameter data is usually not time-critical.
- Parameter data is, for instance, operating parameters, motor data and diagnostic information.

SDO return values

If an SDO request is evaluated negatively, a corresponding error code is output:

Index	Description
0x00000000	No fault.
0x05030000	The state of the toggle bit has not changed.
0x05040000	SDO protocol time-out.
0x05040001	Invalid or unknown specification symbol for the client/server command.
0x05040005	The space in the main memory is not sufficient.
0x06010000	Unsupported access to an object.
0x06010001	Read access to a write-only object.
0x06010002	Write access to a read-only object.
0x06020000	An object is not available in the object directory.
0x06040041	An object cannot be mapped into the PDO.
0x06040042	The number and/or length of the mapped objects would exceed the PDO length.
0x06040043	General parameter incompatibility.
0x06040047	General internal incompatibility in the device.
0x06060000	The access has failed due to errors in the hardware.
0x06070010	The data type or the parameter length do not match.
0x06070012	Wrong data type: The parameter length is too big.
0x06070013	Wrong data type: The parameter length is too small.
0x06090011	A subindex is not available.
0x06090030	The value range for parameters is too big (only in case of write access).
0x06090031	The parameter value is too high.
0x06090032	The parameter value is too low.
0x06090036	The maximum value is smaller than the minimum value.
0x08000000	General fault.
0x08000020	Data cannot be transferred to the application or saved in the application.
0x08000021	Due to local control, the data cannot be transferred to the application or saved in the application.
0x08000022	Due to the current device state, the data cannot be transferred to the application or saved in the application.
0x08000023	The dynamic object directory generation has failed or no object directory is available.



12.9.5 Parameter download

Parameter settings are not stored in a power failure safe manner when using the inverter as a system drive in the Lenze system. All inverter settings that deviate from the Lenze default setting are held centrally in the Lenze controller and saved there persistently. All parameters are transferred from the Lenze controller to the inverter during initialization upon start-up.

All size-dependent parameters are not downloaded.

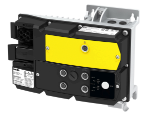
The parameters of the inverter are managed in the »PLC Designer« project. The »PLC Designer« project, including the parameters, is saved on the engineering PC using the storage function of »PLC Designer«. The »PLC Designer« transfers the parameters to the Lenze controller when the controller is logged on to. The controller passes the parameter sets to the subordinate controller. The parameter sets are written back to the inverter by the Lenze controller every time the system starts.

There are three application for managing and modifying parameters:

- Modifying the parameters of an inverter online:
  - If a parameter is modified online, the »PLC Designer« writes the parameter directly to the corresponding inverter and simultaneously modifies the parameter in the »PLC Designer«- project.

The parameter modification is not registered in the Lenze controller. The parameter modification in the inverter is lost when the controller is cold-started. Log out and log back in again with the »PLC Designer« to avoid this. (**Menu commands: Online → Log out / Online → Log in**)

  - In this case, the complete parameter set is written to the controller and transferred to the inverter.
  - The parameter set is only available in the inverter and controller after the transfer by logging in until the system is next shut down (not stored in a power failure safe manner).
- Modifying the parameters of an inverter offline:
  - If a parameter is modified offline, the »PLC Designer« modifies the value directly in the »PLC Designer« project. When logging into the Lenze controller, the complete parameter set is written to the controller. It then transfers the parameter set to the inverter.
  - The parameter set is only available in the inverter and controller after the transfer by logging in until the system is next shut down (not stored in a power failure safe manner).
- Saving the parameters of the inverter in the Lenze controller so that they remain in the device after switching off:
  - A separate parameter set for the subordinate inverters is available in the boot project of the Lenze controller. It is only updated if the "Create boot project" function is executed via the »PLC Designer«. The current parameterisation is then saved and is available after the mains connection. The stored parameter set is automatically written to the inverter by the controller at boot-up following mains connection.
  - If a boot project exists on the Lenze controller, the parameters of the inverter can also be modified with »EASY Starter« and stored permanently.



Modifying parameters and permanently storing them.

1. Open »EASY Starter«.
2. Connect to the inverter online

3. Modify desired parameters.
4. Connect to the Lenze controller online.
5. Select 'Safe parameter set in the device (F6)'.

The Lenze controller then starts uploading the parameters of all its EtherCAT slaves (including i550 EtherCAT) and stores these parameters together with its own parameter set in its boot project. The stored parameter set for the i550 EtherCAT is automatically written to the inverter by the controller when the Lenze controller powers up after mains connection.

If the modified parameter set from the inverter should correspond to the »PLC Designer« project:

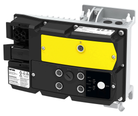
6. Log in to the Lenze controller.
7. If the dialogue displays differences in the parameter selection, select ***Upload all***.
8. Save the »PLC Designer« project.

12.9.6 Monitoring

The parameters for setting network monitoring functions are described below.

Parameter

Address	Name / setting range / [default setting]		Information
0x2859:001	Network monitoring: Watchdog elapsed		Selection of the response to a permanent interruption of the communication to the IO controller. Associated error code: • 33168 | 0x8190 - Network - Watchdog time-out
	0	No response	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	
0x2859:003	Network monitoring: Invalid configuration		Selection of the response triggered by the reception of invalid configuration data. Associated error code: • 33414 | 0x8286 - Network - PDO mapping error
	0	No response	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	
0x2859:004	Network monitoring: Initialisation error		Selection of the response triggered by the occurrence of an error during the initialization of the network component. Associated error code: • 33170 | 0x8192 - Network - Initialization error
	0	No response	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	



Address	Name / setting range / [default setting]		Information
0x2859:005	Network monitoring: Invalid process data		Selection of the response triggered by the reception of invalid process data. Process data marked as invalid (IOPS is "BAD") are received by the IO Controller. Typically in case of • a PLC in STOP state, • alarms, • acyclic demand data. Associated error code: • 33171 | 0x8193 - Network - Invalid cyclic process data
	0	No response	Error types 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	

12.9.7 Diagnostics

12.9.7.1 LED status display

The "BUS RUN" and "BUS ERR" LEDs indicate the network status.

"RUN" LED (green)	EtherCAT status	Status/meaning
off	off / Init	The network option is not active at the network or is in the "Init" status.
blinking	Pre-Operational	Access to parameters and objects possible. No process data exchange.
	Safe-Operational	The data is not active yet in the standard device.
on	Operational	The network option works correctly.
flickers	Bootstrap	Firmware update of the network option active.

"ERR" LED (red)	Status/meaning
off	No fault
flickers	Local error. The network option changes automatically to the "Safe-Operational" status.
on (red)	A "Sync Manager Watchdog Timeout" has occurred.
blinking	The configuration is invalid/incorrect.

The "L/A" LEDs indicate the connection status of ports X396 and X397.

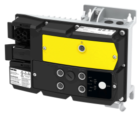
LED "L/A"	Status	Meaning
off	Not connected	Network not available
on	Connected	Network available No data transfer
blinking	Traffic	Data transfer

12.9.7.2 Information on the network

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x2362:004	Active EtherCAT settings: Device identifier • Read only	Display of the clear device address in the network which is defined via rotary encoder switch or object 0x2361:004.
0x2362:006	Active EtherCAT settings: Station address • Read only	Display of the active station address.
0x2362:007	Active EtherCAT settings: Tx length • Read only	Display of the length of the transmitted cyclic data in bytes.

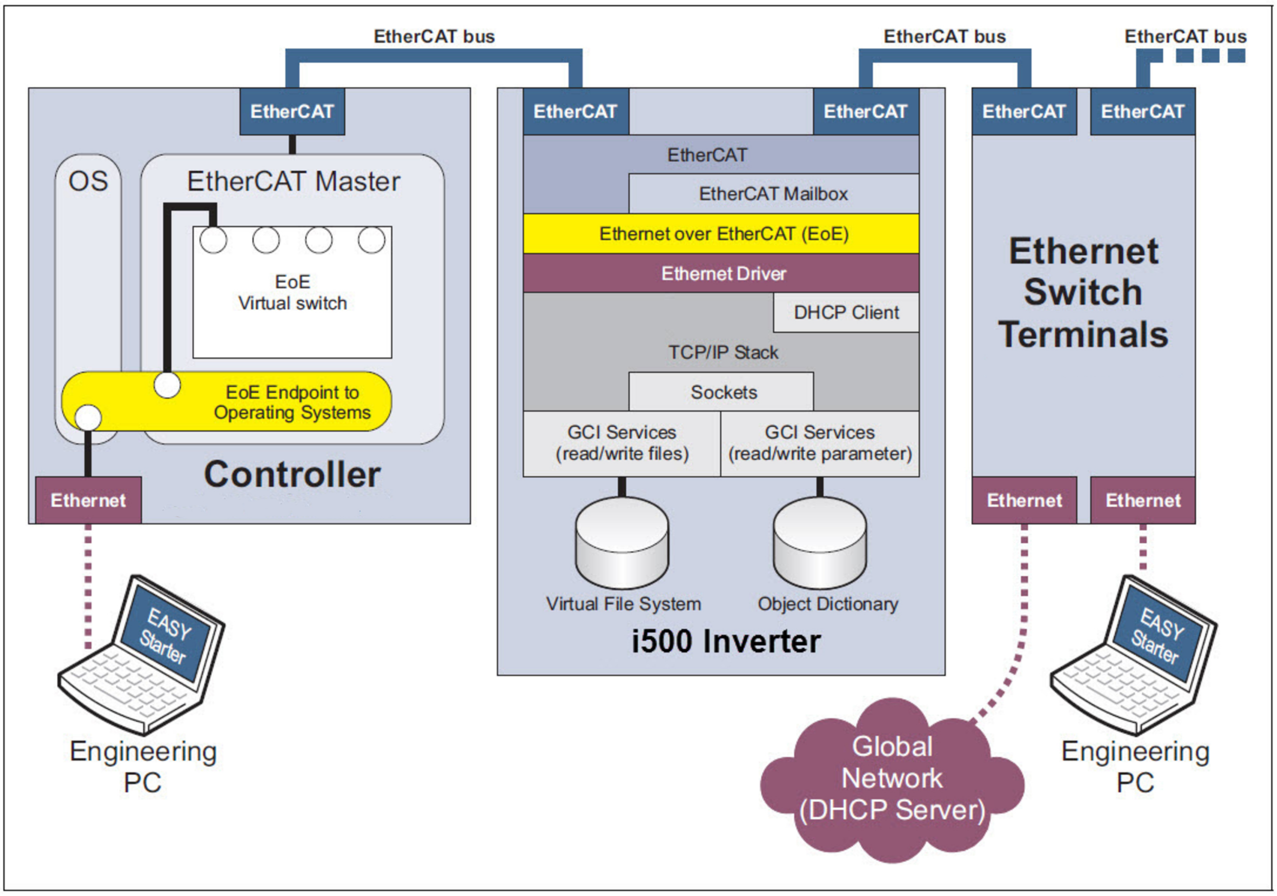


Address	Name / setting range / [default setting]		Information
0x2362:008	Active EtherCAT settings: Rx length • Read only		Display of the length of the received cyclic data in bytes.
0x2367:001	EtherCAT service status: Download parameter file • Read only		
0x2368	EtherCAT status • Read only		Display of the current network status.
	1	Initialization	Network initialization is active. • No PDO/SDO transmission. • Device identification is possible by network scan.
	2	Pre-Operational	The network is active. • SDO transmission (CoE communication via mailbox) is possible. • No PDO transmission.
	3	Bootstrap	Firmware update active. • For the firmware update, the FoE protocol is used. • No PDO transmission.
	4	Safe-Operational	• SDO transmission (CoE communication via mailbox) is possible. • PDO transmission: - The input data in the process image are updated. - The output data from the process image are not transmitted.
	8	Operational	Normal operation • PDO/SDO transmission is possible. • Network synchronisation is successful (if used).
0x2369	EtherCAT error • Read only		Bit coded display of EtherCAT errors.
	Bit 0	Watchdog elapsed	
	Bit 2	Invalid configuration	
	Bit 3	Stack init error	
	Bit 4	Invalid process data	

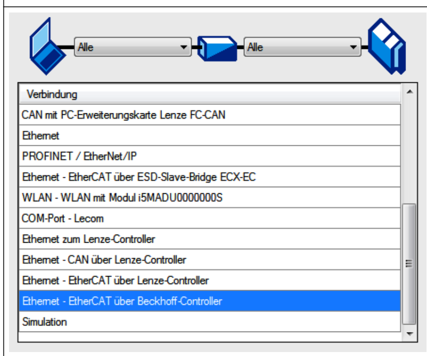
12.9.8 EoE communication

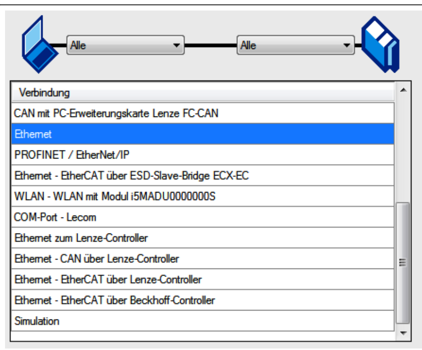
The "Ethernet over EtherCAT (EoE)" is used to send standard Ethernet telegrams via the EtherCAT network without affecting the real-time communication of the EtherCAT process data. This extension facilitates the set-up of parameter communication (SDO communication) with the inverters on the EtherCAT bus by means of a standard Ethernet connection (e.g. from a PC with »EASY Starter«).

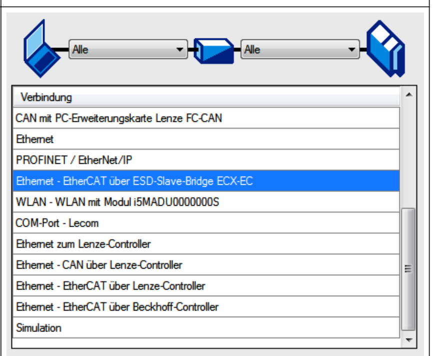
System architecture



Beckhoff controller	Lenze / other controllers	ESD - Slave bridge

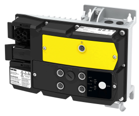






Supported protocols and services

- ARP
- DHCP
- ICMP (ping)
- UDP/TCP
- GCI-SDO communication



Display of EoE-specific information

The following table can be used to read EoE-specific information for diagnostic purposes.

Parameter

Address	Name / setting range / [default setting]	Information
0x2362:001	Active EtherCAT settings: EoE IP address • Read only	
0x2362:002	Active EtherCAT settings: EoE subnet mask • Read only	
0x2362:003	Active EtherCAT settings: EoE gateway • Read only	
0x2362:005	Active EtherCAT settings: EoE virtual MAC address • Read only	

12.10 EtherNet/IP

EtherNet/IP™ (EtherNet Industrial Protocol) is a fieldbus system based on Ethernet which uses the Common Industrial Protocol™ (CIP™) for data exchange.

- EtherNet/IP™ and Common Industrial Protocol™ (CIP™) are trademarks and patented technologies, licensed by the user organisation ODVA (Open DeviceNet Vendor Assoziation).
- Detailed information on EtherNet/IP can be found on the web page of the user organisation: http://www.odva.org
- Information about the dimensioning of a EtherNet/IP network can be found in the planning manual for the inverter.

The inverter can be controlled by every CIP Generic Master that either uses "Class 1 Messaging" or "Class 3 Messaging". For this purpose, the inverter must be configured as AC-Drive-Adapter with the programming software »RSLogix™ 5000« from Rockwell Automation® Corporation. Commissioning 331

Registered trademarks used or trademarks of the Rockwell Automation® Corporation, USA:

- »RSLogix™«, »RSLogix™ 5000«
- »Allen-Bradley®«
- »CompactLogix™«, »ControlLogix®«, »SoftLogix™«

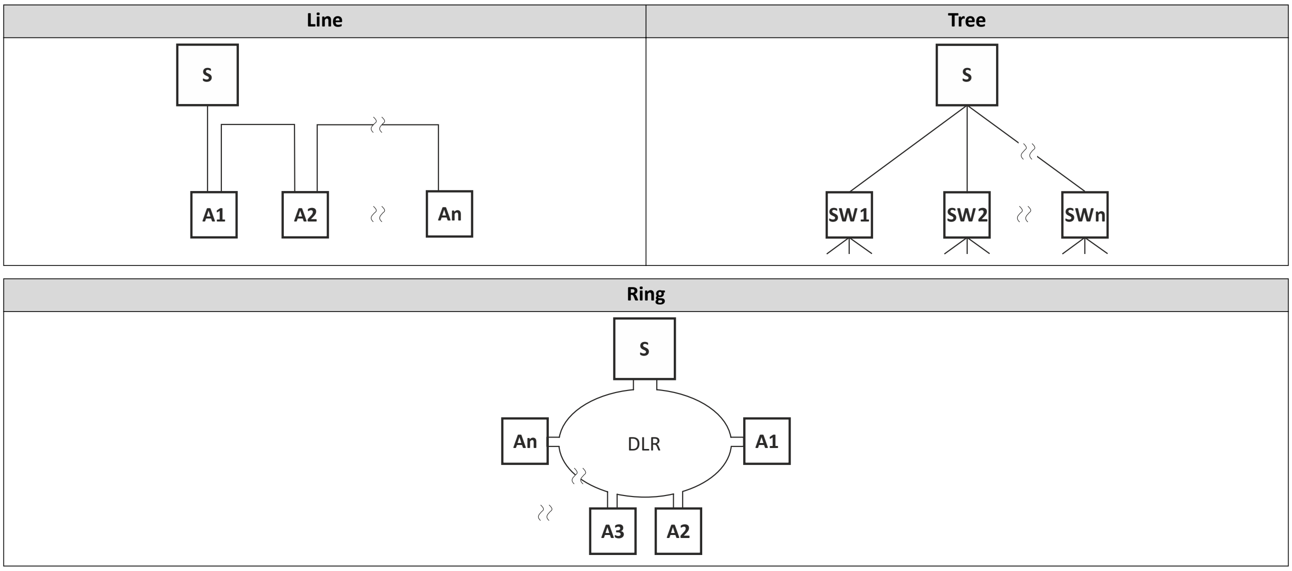
Prerequisites:

In 0x231F:005 the network selection is set to "EtherNet/IP".

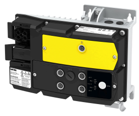
EtherNet/IP connection

The connection is made via the M12 connectors **X396** (IN) and **X397** (OUT).

Typical topologies



S	Scanner	SW	Switch
A	Adapter		



12.10.1 AC drive profile

For control via the AC drive profile, the parameters listed in the following can be mapped to network registers.

- Mapping entry for the AC Drive control word (0x400B:001): 0x400B0110
- Mapping entry for the AC Drive status word (0x400C:001): 0x400C0110
- Detailed information on the data mapping can be found in the chapter of the corresponding network.

12.10.2 Supported CIP objects

An object is described by its class, instances and attributes. Various services, such as reading or writing services, can be applied to the objects.

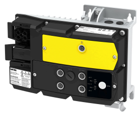
This chapter only describes the CIP objects implemented by Lenze and their supported features (attributes).

Not all object features as described in the "Common Industrial Protocol Specification" of the ODVA are supported.

12.10.2.1 0x01-Identity Object

The "Identity Object" provides the identification and the general information on the device.

Attribute (Instance ID)	Name	Information
1	Vendor ID	Lenze
2	Device Type	2 (AC Drive)
3	Product Code	550
4	Revision	E.g.: "1.5"
5	Status	
6	Serial Number	
7	Product Name	IOFW51AGXX
8	State	



12.10.2.2 0x04-Assembly Object

The inverter contains EtherNet/IP assembly object instances which refer to the following »RSLogix™ 5000«connection parameters:

- Inputs (actual value such as actual speed, actual position, etc.)
- Outputs (enable and reference value for the drive)
- Configuration

The inputs and outputs refer to the view of the Scanner (PLC).

Output data/assemblies are created by the Scanner (PLC) and transmitted to the Adapter (inverter).

Input data/assemblies are created by the Adapter (inverter) and transmitted to the Scanner (PLC).

The assembly object instances can be accessed via "Class 1 Messaging" (Implicit Messaging) and "Class 3 Messaging" (Explicit Messaging).

Customer specific configurations with the assembly object instances 110 and 111 are only possible with PLCs (Scanner) that support "Class 1 Messaging".

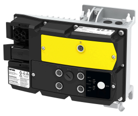
See also "EtherNet/IP” section:

▶ Process data transfer 📖 337 (Implicit Messaging)

▶ Parameter data transfer 📖 348 (Explicit Messaging)

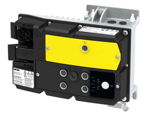
The Ethernet connection object offers the following common services for accessing the assembly object instances:

- 0x0E: Get_Attribute_Single (read parameter/assembly data)
- 0x10: Set_Attribute_Single (write parameter/assembly data)



The following predefined assembly object instances can be used according to the "CIP™ Network Library":

Attribute (Instance ID)	Name	Info / parameter
Assembly output object instances according to AC Drive profile		
20	Basic Speed Control Output	LSB of the AC Drive control word 0x400B:001 (some bits are masked) ▸ 0x400B:004 Network setpoint speed
21	Extended Speed Control Output	LSB of the AC-Drive control word 0x400B:001 ▸ 0x400B:004 Network setpoint speed
22	Speed and Torque Control Output	LSB of the AC Drive control word 0x400B:001 (some bits are masked) ▸ 0x400B:004 Network setpoint speed ▸ 0x400B:008 Torque mode setpoint
23	Extended Speed and Torque Control Output	LSB of the AC-Drive control word 0x400B:001 ▸ 0x400B:004 Network setpoint speed ▸ 0x400B:008 Torque mode setpoint
Assembly input object instances according to the AC Drive profile		
70	Basic Speed Control Input	LSB of the AC Drive status word 0x400C:001 (some bits are masked) ▸ 0x400C:004 Motor speed
71	Extended Speed Control Input	LSB of the AC-Drive status word 0x400C:001 ▸ 0x400C:004 Motor speed
72	Speed and Torque Control Input	LSB of the AC-Drive status word 0x400C:001 ▸ 0x400C:004 Motor speed ▸ 0x400C:007 Torque scaled
73	Extended Speed and Torque Control Input	LSB of the AC-Drive status word 0x400C:001 MSB Drive State of the AC Drive status word (mask bits 12 ... 15) ▸ 0x400C:004 Motor speed ▸ 0x400C:007 Torque scaled
Assembly object instances for customer specific configurations		
110	Custom Output	Customized The inverter must be registered with an EDS device description file in »RSLogix™ 5000« to be able to assign data to these assembly object instances.
111	Custom Input	



Assembly output objects (outputs)

Assembly output objects are usually used to enable the inverter (Adapter) and define a speed or torque setpoint.

Depending on the data length defined by the PLC (Scanner) the memory map of the I/O data may vary in size.

In case of assembly output objects, a 32-bit-run/idle header is assumed. When the assemblies are mapped, this header is inserted automatically into the data flow by most of the Allen-Bradley PLC/SLC devices. For this purpose, no adaptations are required.

If your PLC does not support the 32-bit run/idle header, complement the output image by a leading 32-bit header. Set the data in the header to 0.

Bit 0 of the header can be defined in the process image of your PLC:

- Status 0 Idle mode
- Status 1 Run mode

Structure of the output objects

Attribute (Instance ID)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20 (0x14)	0						FaultRst		RunFwd (CW)
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
21 (0x15)	0		NetRef	NetCtrl			FaultRst	RunRev (CCW)	RunFwd (CW)
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
22 (0x16)	0						FaultRst		RunFwd (CW)
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
	4	Torque Reference (low byte)							
	5	Torque Reference (high byte)							
23 (0x17)	0		NetRef	NetCtrl			FaultRst	RunRev (CCW)	RunFwd (CW)
	1								
	2	Speed Reference (low byte)							
	3	Speed Reference (high byte)							
	4	Torque Reference (low byte)							
	5	Torque Reference (high byte)							
110 (0x6E)	0 … 31	Custom Output							

Assembly input objects (inputs)

Assembly input objects are usually used to monitor the status of the inverter (Adapter) and request current actual values (e. g. the current speed).

The input objects are mapped in the Adaptermemory from byte 0 and transmitted "modeless".

The inverter does not use a 32-bit header for the real time status. Thus, the start address in the assembly memory map is the real start of the first assembly data element.

When the assembly input objects are mapped to the control memory, observe the real assembly lengths.

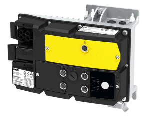
Structure of the input objects

Attribute (Instance ID)	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70 (0x46)	0						Running1 (Fwd, CW)		Faulted
	1								
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
71 (0x47)	0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2 (Rev, CCW)	Running1 (Fwd, CW)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
72 (0x48)	0						Running1 (Fwd, CW)		Faulted
	1								
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
	4	Torque Actual (low byte)							
	5	Torque Actual (high byte)							
73 (0x49)	0	AtReference	RefFromNet	CtrlFromNet	Ready	Running2 (Rev, CCW)	Running1 (Fwd, CW)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (low byte)							
	3	Speed Actual (high byte)							
	4	Torque Actual (low byte)							
	5	Torque Actual (high byte)							
111 (0x6F)	0 … 31	Custom Input							

12.10.2.3 0x28-Motor Data Object

The "Motor Data Object" provides a data basis for motor parameters.

Attribute (Instance ID)	Name	Info / parameter
3	Motor Type	▶ 0x6402 Motor type Default setting: Squirrel cage induction
6	Rated Current [mA]	▶ 0x6075 Rated motor current
7	Rated Voltage [V]	▶ 0x2C01:007 Rated voltage



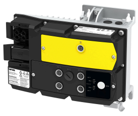
12.10.2.4 0x29-Control Supervisor Object

The "Control Supervisor Object" describes all management functions of the device for the motor control.

Attribute (Instance ID)	Name	Info / parameter
3	Run1	AC drive control word 0x400B:001: Bit 0 (run forward, CW)
4	Run2	AC drive control word 0x400B:001: Bit 1 (run backward, CCW)
5	NetCtrl	AC Drive control word 0x400B:001: Bit 5 (activate network control: 0x2631:037 = 114)
6	State	AC drive status word 0x400C:001: Bits 8 ... 11 (profile status/Drive State) Bits 12 ... 15 masked
7	Running1	AC drive status word 0x400C:001: Bit 2 (run forward active, CW)
8	Running2	AC drive status word 0x400C:001: Bit 3 (run backward active, CCW)
9	Ready	AC drive status word 0x400C:001: Bit 4 (ready)
10	Faulted	AC drive status word 0x400C:001: Bit 0 (fault/trouble active)
11	Warning	AC drive status word 0x400C:001: Bit 1 (warning active)
12	FaultRst	AC drive control word 0x400B:001: Bit 2 (error reset)
13	FaultCode	Error code 0x603F
15	CtrlFromNet	AC drive status word 0x400C:001: Bit 5 (network control active)

Assignment of "CiA 402 plus States" to ""AC Drive Profile Drive States"

<table>
<tr><th>CiA 402 plus States</th><th>AC Drive Profile Drive States</th></tr>
<tr><td>INIT (0, 1)</td><td>0: Manufacturer-specific</td></tr>
<tr><td>NOT_READY_TO_SWITCH_ON (2)</td><td>1: Startup (drive initialization)</td></tr>
<tr><td>SWITCH_ON_DISABLED (3)</td><td>2: Not_Ready (mains voltage switched off)</td></tr>
<tr><td>READY_TO_SWITCH_ON (4)</td><td rowspan="2">3: Ready (mains voltage switched on)</td></tr>
<tr><td>SWITCHED_ON (5)</td></tr>
<tr><td>OPERATION_ENABLED (6)</td><td>4: Enabled (drive has received run command)</td></tr>
<tr><td>DISABLE_OPERATION (7)</td><td rowspan="3">5: Stopping (drive has received stop command and is stopped)</td></tr>
<tr><td>SHUT_DOWN (8)</td></tr>
<tr><td>QUICK_STOP (9)</td></tr>
<tr><td>FAULT_REACTION_ACTIVE (10)</td><td>6: Fault_Stop (drive is stopped due to a fault)</td></tr>
<tr><td>FAULT (11)</td><td>7: Faulted (faults have occurred)</td></tr>
</table>



12.10.2.5 0x2A-AC Drive Object

The "AC Drive Object" describes the device-specific functions of the inverter, e. g. speed ramps, torque control etc.

Attribute (Instance ID)	Name	Info / parameter
3	AtReference	AC drive status word 0x400C:001: Bit 7 (At Reference)
4	NetRef	AC drive control word 0x400B:001: Bit 6 (activate network setpoint) Activate network setpoint: 0x2631:017 = 116
6	DriveMode	AC Drive mode 0x400B:010
7	SpeedActual [rpm / $2^{SpeedScale}$]	Current motor speed 0x400C:004 A speed scale parameter is not supported.
8	SpeedRef [rpm / $2^{SpeedScale}$]	Setpoint speed 0x400B:004 A speed scale parameter is not supported.
11	TorqueActual [Nm / $2^{TorqueScale}$]	Current torque (scaled) 0x400C:007
12	TorqueRef [Nm / $2^{TorqueScale}$]	Torque setpoint 0x400B:008 The scaling factor can be set with 0x400B:009. Example: • Torque setpoint (0x400B:008) = 345 [Nm] • Scaling factor (0x400B:009) = 3 • Scaled torque setpoint = 345 [Nm] / 2^3 = 43.125 [Nm]
22	SpeedScale	Not implemented. Use the value "0" for SpeedScale .
24	TorqueScale	0x400B:009 = torque scaling of TorqueRef (0x400B:008) and TorqueActual (0x400C:007)
29	RefFromNet	AC drive status word 0x400C:001: Bit 6 (Reference from Network)

The following table shows the negative influence of an AC Drive mode on the mode selection parameters of the inverter.

Impacts of the AC Drive mode on the mode selection parameters of the inverter

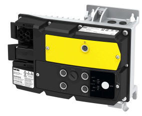
0x400B:010 AC Drive mode 0x2A: AC Drive Object Attribute 6: Drive Mode	0x6402 Motor type	0x6060 CiA: Operation mode	0x2C00 Motor control mode	0x4020:001 Operating mode
0: Vendor specific	Unchanged	Unchanged	Unchanged	Unchanged
1: Speed control (open loop)	7: Squirrel cage induction	2: MS: Velocity mode	6: V/f characteristic control (VFC open loop)	0: Inhibited
2: Speed control (closed loop)	7: Squirrel cage induction	2: MS: Velocity mode	2: Servo control (SC ASM)	0: Inhibited
3: Torque control	7: Squirrel cage induction	1: MS: Torque mode	Unchanged	0: Inhibited

12.10.2.6 0x47-Device Level Ring (DLR) Object

The "Device Level Ring (DLR) Object" provides status information for the DLR protocol. The DLR protocol is a "layer 2" protocol enabling the use of an Ethernet ring topology.

0x47: Device Level Ring (DLR) Object

Attribute (Instance ID)	Name	Information
1	Network Topology	Current network topology • 0: Line topology • 1 Ring topology
2	Network Status	Current network status • 0: Normal • 1 Ring Fault (only for ring topology) • 2: Unexpected Loop Detected (only for line topology) • 3: Partial Network Fault • 4: Rapid Fault/Restore Cycle
10	Active Supervisor Address	IP address and MAC address of the active ring supervisor
12	Capability Flags	Telegram processing method for the ring node implementation • 2: Beacon-based ring node



12.10.2.7 0x48-Quality of Service (QoS) Object

The "Quality of Service (QoS) Object" enables different classifications and prioritizations of the data packets for the EtherNet/IP communication. For this purpose the EtherNet/IP messages are marked with "Differentiated Services Codepoints" (DSCP).

0x48: Quality of Service (QoS) Object

Attribute (Instance ID)	Name	Information
4	DSCP Urgent	Default: 55: Urgent/imperative messages
5	DSCP Scheduled	Default: 47 (Scheduled messages)
6	DSCP High	Default: 43 (Messages with high priority)
7	DSCP Low	Default: 31 (Messages with low priority)
8	DSCP Explicit	Default: 27 ("Explicit Messages"/parameter data)

12.10.2.8 0x67-Lenze Class Object 103

The "Lenze Class (0x67)" provides the image of the input data of the scanner.

The input data for the Scanner is sent to the Scanner via the configured assembly input object instance.

0x67: Lenze Class Object 103

Attribute (Instance ID)	Name	Information
3	I/O image of produced data	Image of the scanner input data

12.10.2.9 0x68-Lenze Class Object 104

The "Lenze Class (0x68)" provides the image of the output data of the scanner.

The output data of the scanner is sent via the configured assembly output object instance.

0x68: Lenze Class Object 104

Attribute (Instance ID)	Name	Information
3	I/O image of consumed data	Image of the scanner output data

12.10.2.10 0x6E-Lenze Class Object 110

The "Lenze Class (0x6E)" enables read or write access to Lenze inverter parameters.

The Lenze parameter must be specified as "Instance" and its subindices as "Attribute".

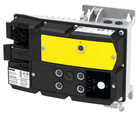
If there is no subindex, the attribute must be set to "0".

If the engineering tool used does not support the attribute value "0", the value '1' must be entered.

Configuration of a display parameter by "Set_Attribute_Single" is not possible.

0x6E: Lenze Class Object 110

Service Type	Instance	Attribute (Instance ID)	Data
Get_Attribute_Single Set_Attribute_Single	Index number of the Lenze parameter	Subindex number of the Lenze parameter or 0x01 for parameters without subindex.	Value of the parameter or subindices

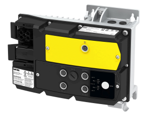


12.10.2.11 0xF5-TCP/IP Interface Object

The "TCP/IP Interface Object" is used to configure the TCP/IP network interface of the device.

0xF5: TCP/IP Interface Object

Attribute (Instance ID)	Name	Info / parameter
1	Status	Current status of the TCP/IP network interface
2	Configuration Capability	Possible options for TCP/IP configuration • DHCP client • Config. Settable • ACD capable
3	Configuration Control	Type of the TCP/IP configuration 0x23A1:005 Possible values for bit 0 ... 3 • 0000: Static TCP/IP configuration • 0010: TCP/IP configuration via DHCP
4	Physical Link Object	Path to "Physical Link Object"
5	Interface Configuration	Current TCP/IP configuration • IP address: 0x23A1:001 • Subnetwork: 0x23A1:002 • Gateway: 0x23A1:003 "Interface Configuration Change Requires Reset" is not supported, i.e. a write access to attribute 5 is implemented immediately!
6	Host Name	Host name: 0x23A1:004
8	TTL Value	TTL value for EtherNet/IP multicast data packages: 0x23A1:006
9	Mcast Config	Multicast settings • Multicast assignment: 0x23A1:007 • Multicast IP address: 0x23A1:008 • Multicast number: 0x23A1:009
10	SelectAcd	Activate address conflict detection (ACD) 0x23A7 • 0: Deactivate ACD • 1 Activate ACD
11	LastConflictDetected	ACD diagnostic information about the last address conflict that occurred.
13	Encapsulation Inactivity Timeout	Number of seconds of inactivity before the TCP connection session is closed.



12.10.2.12 0xF6-Ethernet Link Object

The "Ethernet Link Object" provides general information and status information of the Ethernet interfaces (IEEE 802.3)

Instance 1 for interface X266, instance 2 for interface X267.

0xF6: Ethernet Link Object

Attribute (Instance ID)	Name	Info / parameter
1	Interface Speed	Current baud rate • 10 Mbps • 100 Mbps
2	Interface Flags	Status bits of the Ethernet interface The change of an attribute of the interface configuration becomes effective immediately.
3	Physical Adress	MAC address of the Ethernet interface: 0x23A2:005
4	Interface Counters	Interface-specific counter
5	Media Counters	Media-specific counter
6	Interface Control	Interface settings • Port 1: 0x23A4:001 • Port 2: 0x23A4:002
7	Interface Type	Twisted Pair is supported.
8	Interface State	Interface status
9	Admin State	Administrative setting of the interface status • Enable interface • Disable interface
10	Interface Label	Text for the identification/designation of the Ethernet interface • X266 (instance 1) • X267 (instance 2)
11	Interface Capability	• Manual settings are effective immediately (no reset required). • Autonegotiation is supported. • Auto-MDIX is supported. • Manual setting of Speed and Duplex is supported.

12.10.3 AC motor type

Parameter

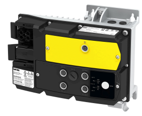
Address	Name / setting range / [default setting]		Information
0x6402	Motor type		
	0	Non-standard motor	
	1	Phase modulated DC motor	
	2	Frequency controlled DC motor	
	3	PM synchronous	
	4	FC synchronous motor	
	5	Switched reluctance motor	
	6	Wound rotor induction	
	7	**Squirrel cage induction**	
	8	Stepper motor	

12.10.4 Commissioning

The steps required to control the device as an EtherNet/IP adapter with a Rockwell EtherNet/IP scanner are described below.

Preconditions

- The inverter is provided with EtherNet/IP.
- The inverter is networked as EtherNet/IP Adapter with an EtherNet/IP Scanner and, if necessary, further EtherNet/IP nodes.
  - Typically, an EtherNet/IP network consists of segments that contain point-to-point connections in a star configuration.
  - See also "Typical topologies" under: EtherNet/IP 🕮 319
- An Engineering PC with the programming software »RSLogix™ 5000« (from version 20) is connected to the Scanner.
- Current device description files for EtherNet/IP are available.
  - Download of EDS files
  - The files are installed via the "EDS Hardware Installation Tool" of the »RSLogix™ 5000«.
  - Allen-Bradley control systems do not need any EDS files to add devices to their configuration.
- An »RSLogix™ 5000« project has been created and is in the offline state.
- The CPU and Ethernet adapter of the PLC (Scanner) have been configured.
- All EtherNet/IP nodes are supplied with voltage and are switched on.



Commissioning with »RSLogix™ 5000« (from version 20)

How to configure the network:

1. **Configure IP communication.**
    1. Make IP basic settings at the Engineering PC.

       The PC with the programming software »RSLogix™ 5000« must be in the same network as the devices to be configured.
    2. Set IP address of the inverter (adapter) via rotary encoder switch and parameter 0x23A1:001.
    3. Set subnet mask: 0x23A1:002
    4. Set gateway address: 0x23A1:003

       The configuration of the IP communication is now completed.
2. **Activate network control in the inverter.**
    1. Activate network control: 0x2631:037 = "Network control active [114]"
    2. Set network as standard setpoint source: 0x2860:001 ="Network [5]"

       If another default setpoint source is set, switching to the network setpoint is possible via the AC drive control word 0x400B:001 when network control is activated.

       The network control is now activated.
    3. Save parameter settings: 0x2022:003 = "On / start [1]"
3. **Execute I/O configuration with »RSLogix™ 5000« (version 20).**
    1. Start the »RSLogix™ 5000«.
    2. Open or recreate a »RSLogix™« project.
    3. Configure the cyclic data transfer (Implicit Messaging).

       ▶ Process data transfer 📖 337
    4. Configure the acyclic data transfer (Explicit Messaging).

       ▶ Parameter data transfer 📖 348

       The configuration of the network is now completed.
4. **Complete the commissioning:**
    1. Save the "RSLogix™" project and load the configuration into the PLC (scanner).

       ▶ Save »RSLogix™« project/Load configuration into the Scanner 📖 333
    2. Restart communication, when the EtherNet/IP configuration has been changed.

       ▶ Restarting or stopping the communication 📖 334

Commissioning is completed.

Control the inverter via the network

In the default setting, the digital input DI1 is assigned the "Run" function. If the network control is activated, this function serves as "start enable" for start commands via network. Hence, the digital input DI1 must be set to the HIGH level in order that the motor can be started via the network.

▸ Flexible I/O configuration of the start, stop and rotating direction commands 📖 52

In order that the inverter can be controlled via the network, activate the network control: 0x2631:037 = "Network control active [114]"

Select "Network [5]" in 0x2860:001 to use the network generally as a standard setpoint source. If another standard setpoint source is set, a change-over to the network setpoint via the AC Drive control word 0x400B:001 is possible in case the network control is activated:

Change-over to network setpoint	
The network setpoint is activated via bit 6 (NetRef) of the AC Drive control word:	
Bit 6	Selection:
0	Standard setpoint source selected in 0x2860:001.
1	Network setpoint
Note! In order that the activation via bit 6 works, the selection "Network setpoint active [116]" must be set in 0x2631:017.	

Optionally, a change-over from the standard setpoint source to the network setpoint is also possible via a digital input:

- Set a standard setpoint source different than Network" [5]" in 0x2860:001.
- Set the desired digital input in 0x2631:017 via which the change-over to the network setpoint is to take place.

Bits 5 (NetCtrl) and 6 (NetRef) of byte 0 in the assembly output objects 21 and 23 must be transmitted to the inverter in order that control and speed reference commands are accepted by the network.

If the network control is active (0x400B:001/bit 5 = 1 and 0x2631:037 = 114), all bits of the AC drive control word (0x400B:001) are processed.

If the network control is not active (0x400B:001/bit 5 = 0 or 0x2631:037 = 0), the control bits 0, 1, 12, 13, 14, 15 are *not* processed. Their states are ignored and the drive is in local control.

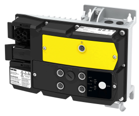
12.10.4.1 Save »RSLogix™« project/Load configuration into the Scanner

To save the "RSLogix™" project and load the configuration into the PLC (scanner):

1. **Save »RSLogix™« project:**
    1. Click ""File"" in the upper toolbar.
    2. Execute the "Save" menu command.
       The configuration is saved in a file on your PC.
2. **Load configuration into the scanner:**
    1. Click "Communications" in the upper toolbar.
    2. Execute the "Download" menu command.
       The "Download" dialog box is opened.
    3. Click "Download".
       The configuration is loaded into the Scanner.

If the download has been completed successfully, »RSLogix™« changes to the online mode.

The I/O-OK field in the upper left area of the screen is green.



12.10.4.2 Restarting or stopping the communication

The communication needs to be restarted after the EtherNet/IP configuration is changed, so that the changed settings can take effect.

For restarting communication, there are two options:

- Switch inverter off and on again.
- Set 0x23A0 = "Restart with current values [1]".

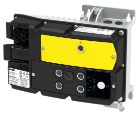
Parameter

Address	Name / setting range / [default setting]	Information
0x23A0	EtherNet/IP communication	Restart / stop communication. • When the device command has been executed successfully, the value 0 is shown. • A communication restart has nothing to do with the acceptance of the described operating modes. For this purpose, a restart of the device is required!
	0 **No action/no error**	Only status feedback
	1 Restart with current values	Restart communication with the current values.
	2 Restart with default values	Restart communication with the standard values.
	10 In process	Only status feedback
	11 Action cancelled	
	12 Fault	

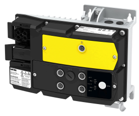
12.10.5 Basic setting and options

Parameter

Address	Name / setting range / [default setting]	Information
0x23A1:001	EtherNet/IP settings: IP address 0.0.0.0 ... [**192.168.124.16**] ... 255.255.255.255	Set IP address.
0x23A1:005	EtherNet/IP settings: IP configuration	Set IP configuration.
	0 Stored IP	The currently saved IP configuration is used.
	1 **BOOTP**	The IP configuration is assigned by the Scanner via BOOTP.
	2 DHCP	The IP configuration is assigned by the Scanner via DHCP. The assignment of a gateway address that is not in the same subnetwork as the IP address, is denied.
0x23A1:002	EtherNet/IP settings: Subnet 0.0.0.0 ... [**255.255.255.0**] ... 255.255.255.255	Set subnet mask.
0x23A1:003	EtherNet/IP settings: Gateway 0.0.0.0 ... [**0.0.0.0**] ... 255.255.255.255	Set gateway address.
0x23A1:004	EtherNet/IP settings: Host name ["**0**"]	Set host name. • String with up to 64 characters.
0x23A1:006	EtherNet/IP settings: Multicast TTL 1 ... [**1**] ... 255	Setting of the multicast TTL value for the validity period of data packets in the network. The TTL value defines the number of hops that the multicast message can distribute via routers.
0x23A1:007	EtherNet/IP settings: Multicast allocation	Selection for multicast-IP addressing.
	0 **Default allocation**	
	1 Multicast number/start address	
0x23A1:008	EtherNet/IP settings: Multicast IP address 0.0.0.0 ... [**239.64.2.224**] ... 255.255.255.255	Set multicast IP address.
0x23A1:009	EtherNet/IP settings: Multicast number 1 ... [**1**] ... 8	Set multicast number.



Address	Name / setting range / [default setting]		Information
0x23A4:001	Port settings: Port 1		Set baud rate for Ethernet port 1.
	0	**Auto-Negotiation**	
	1	10 Mbps	
	2	100 Mbps	
	3	Reserved	
	4	Reserved	
	5	10 Mbps/Half Duplex	
	6	10 Mbps/Full Duplex	
	7	100 Mbps/Half Duplex	
	8	100 Mbps/Full Duplex	
	9	Reserved	
	10	Reserved	
	11	Reserved	
	12	Reserved	
0x23A4:002	Port settings: Port 2		Set baud rate for Ethernet port 2.
	0	**Auto-Negotiation**	
	1	10 Mbps	
	2	100 Mbps	
	3	Reserved	
	4	Reserved	
	5	10 Mbps/Half Duplex	
	6	10 Mbps/Full Duplex	
	7	100 Mbps/Half Duplex	
	8	100 Mbps/Full Duplex	
	9	Reserved	
	10	Reserved	
	11	Reserved	
	12	Reserved	
0x23AA:001	Address conflict settings: Detection		
	0	Disabled	
	1	**Activated**	
0x23AA:002	Address conflict settings: Status • Read only		
	0	No conflict	
	1	Last conflicted IP4 address	
	2	In progress	
	3	Semi Active Probe	
0x23AA:003	Address conflict settings: Last conflicted MAC addr. • Read only		
0x23AA:004	Address conflict settings: Last conflicted IP address • Read only		
0x23AB:001	DLR network diagnostics: Topology • Read only		
	0	Linear	
	1	Ring	
0x23AB:002	DLR network diagnostics: Status • Read only		
	0	OK	
	1	Ring fault	
	2	Unexpected loop	
	3	Partial fault	
	4	Rapid Fault/Restore Cycle	
0x23AB:003	DLR network diagnostics: Supervisor IP address • Read only		



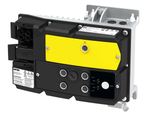
Address	Name / setting range / [default setting]	Information
0x23AB:004	DLR network diagnostics: Supervisor MAC address • Read only	
0x23AB:005	DLR network diagnostics: Beacon interval • Read only: x µs	
0x23AB:006	DLR network diagnostics: Beacon timeout • Read only: x µs	
0x23AB:007	DLR network diagnostics: Port1 beacon frames count. • Read only	
0x23AB:008	DLR network diagnostics: Port2 beacon frames count. • Read only	
0x400B:010	Process input data: AC Drive mode • Read only	Selection of the AC drive mode.
	0 Vendor specific mode	
	1 Open loop speed (frequency)	
	2 Closed loop speed control (ASM)	
	3 Torque control	
	4 Process control (PID)	
	5 Position control	

12.10.6 Process data transfer

The following is an example of the I/O configuration of the Allen-Bradley CompactLogix 1769-L32E controller with Rockwell programming software »RSLogix™ 5000« Version 20 or higher.

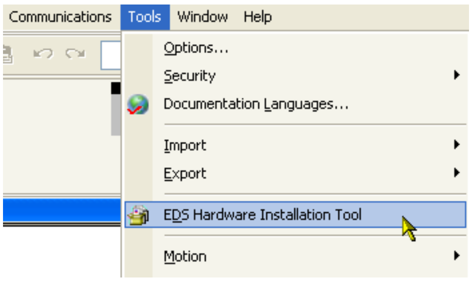
As of »RSLogix™ 5000« version 20, I/O configuration is performed with the aid of EDS files.

Download of EDS files



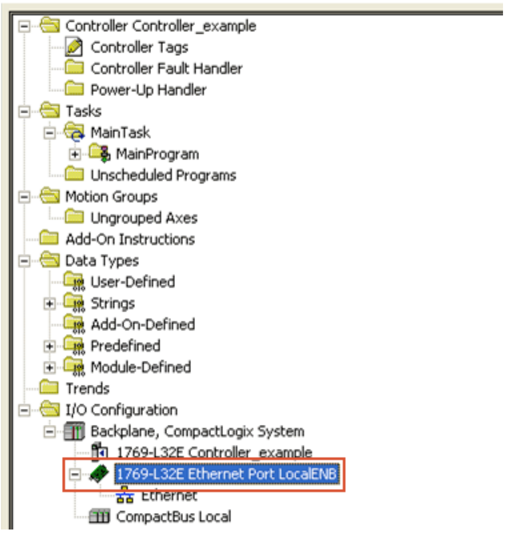
Configure the cyclic data transfer (Implicit Messaging) in »RSLogix™ 5000« (from version 20):

1. Use the "EDS Hardware Installation Tool" to import the EDS files of the EtherNet/IP nodes.



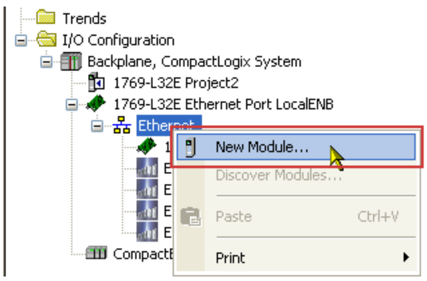
   In »RSLogix™ 5000« the dialog for the "EDS Hardware Installation Tool" is self-explanatory and is not described further here.

2. Click on the "I/O Configuration" folder in the configuration tree.

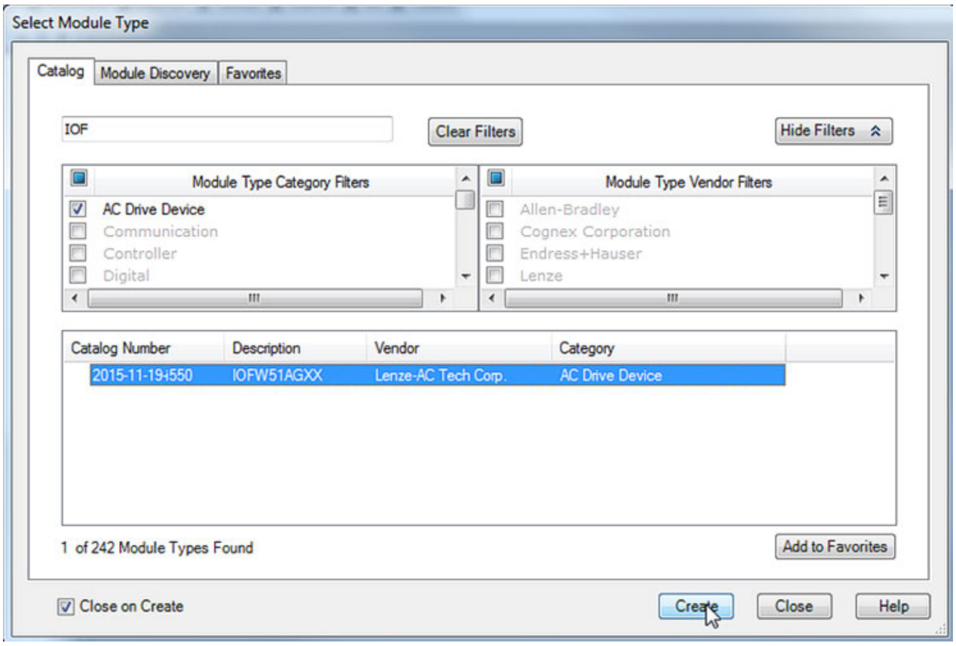


   For the 1769-L32E CompactLogix controller, the I/O configuration already includes a local Ethernet port. If a SoftLogic or ControlLogix controller is used, an Ethernet port scanner must be added to the configuration.

3. Click with the right mouse button on "Ethernet" and execute the command "New Module ..." in the context menu.



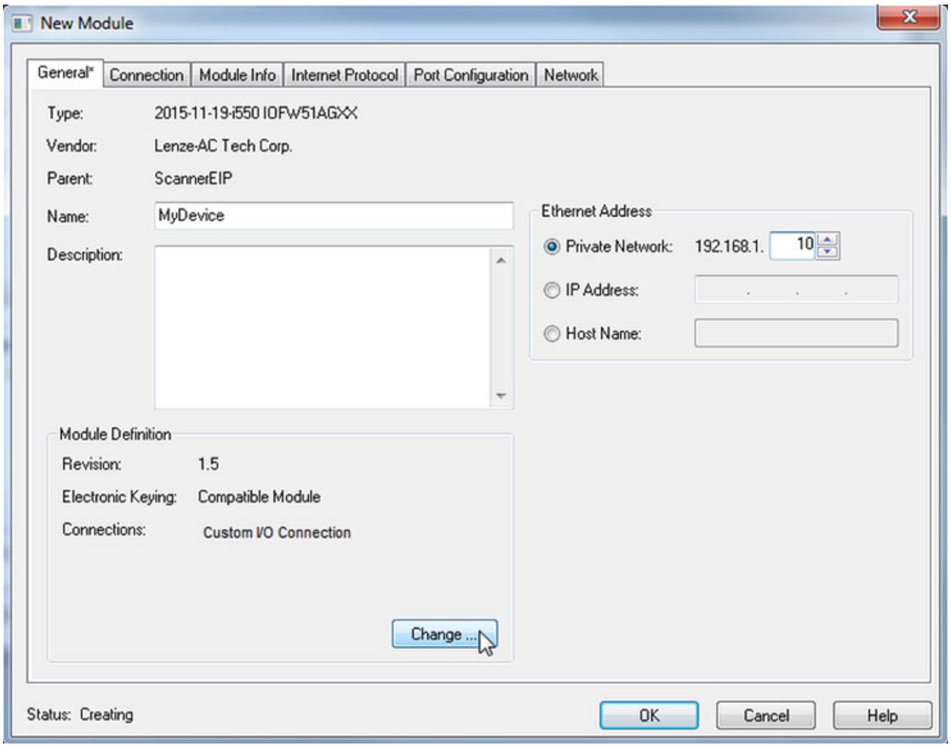
4. Open the dialog "Select Module Type".



5. Under the "Catalog" tab ...
   a) select the "AC Drive Device" type category.
   b) select the "IOFW51AGXX" catalog.

6. Click "Create".

   The "New Module" dialog box is opened.



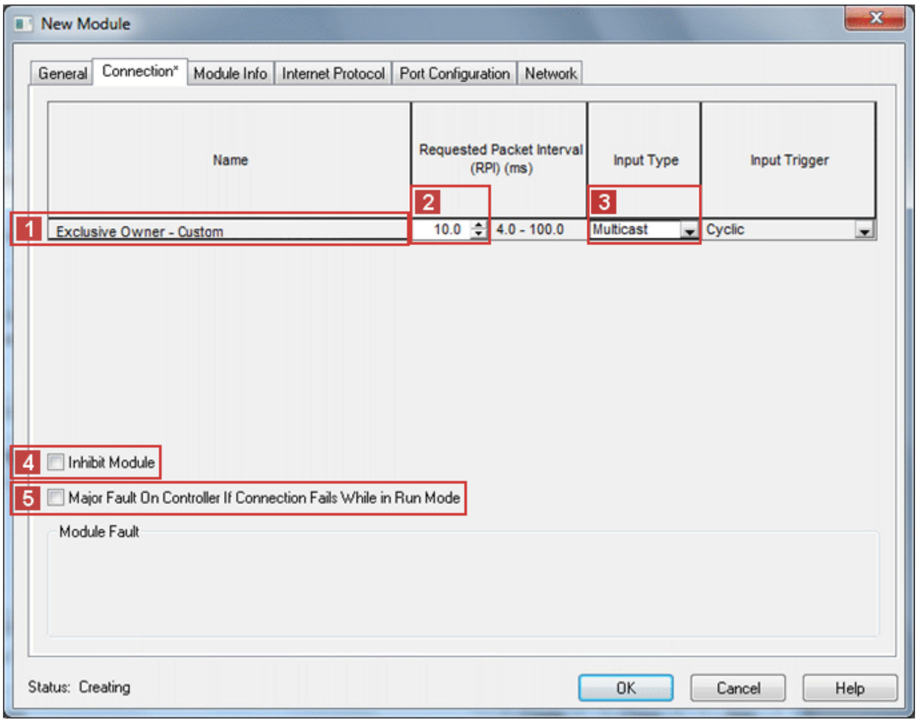
a) The name to be entered should refer to the process or device.

b) When entering the IP address, make sure that the inverter (adapter) is located in the same network as the controller (scanner). The subnet corresponds to the first three bytes of the IP address.

DNS is not supported.

The host name only describes the device.

7. Set other properties under the Connection tab.



Under [1] "Name" the designation of the set connection is displayed.

In the example, an "Exclusive Owner - Custom" connection is displayed. Accordingly, the designation of an "AC Drive Profile" connection can also be displayed here.

Required settings:

[2] "Requested Packet Interval (RPI)": Set RPI ≥ 4.0 ms. (Standard: 10 ms). The RPI [ms] specifies the intervals at which the I/O data is exchanged between the inverter (adapter) and the controller (scanner).

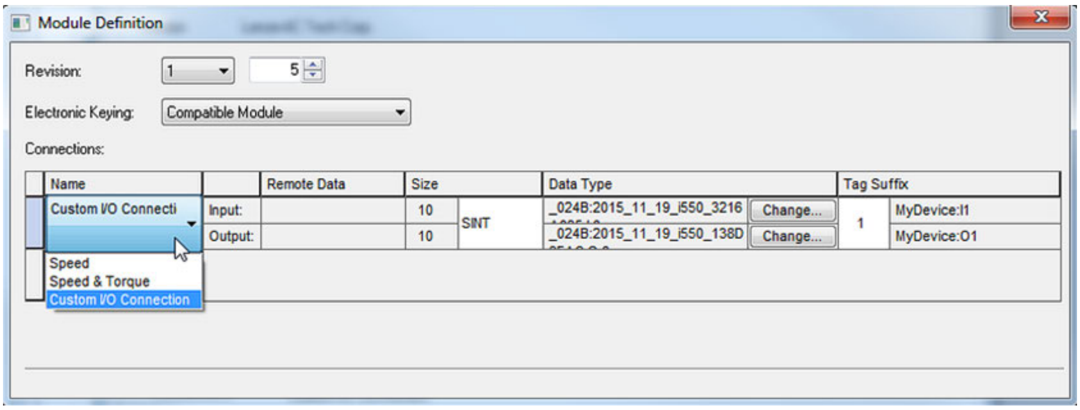
[3] "Input Type": Select input type "Multicast". The input data is sent from the adapter to the scanner by means of multicast telegrams. In addition to the scanner currently being configured, other scanners can access the data ("Listen only" or "Input only" connections).

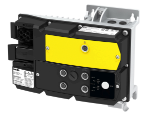
Optional settings:

[4] "Inhibit Module": This option allows you to interrupt or block communication to the adapter.

[5] "Major Fault On...": This option also allows you to set the controller to the error state if the EtherNet/IP connection to the inverter fails while the controller is in operation.

8. Click "Change".
9. Open the "Module Definition" dialog box.





10. Here the access to the I/O data for the technology applications "Speed" and "Torque" or a freely definable I/O process data set is defined.
    a) Select connection "Speed", "Speed & Torque" or "Custom I/O Connection".

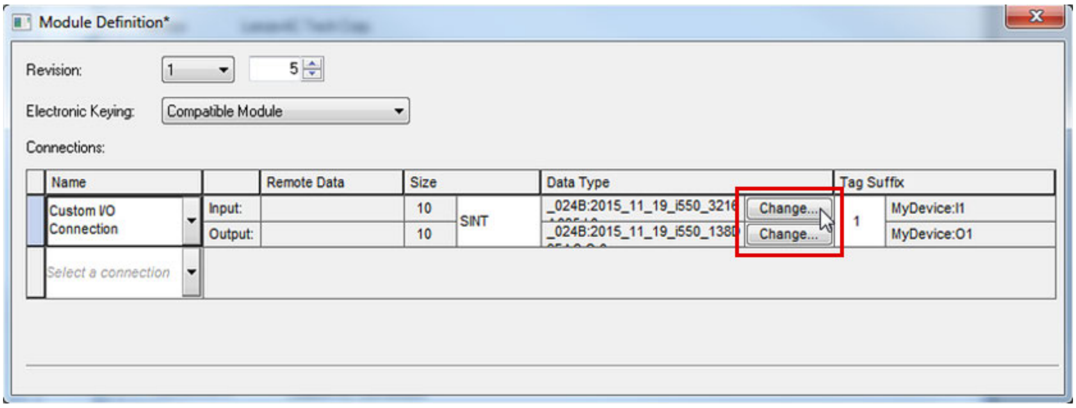
       "Speed" and "Torque" correspond to the ODVA "AC Drive Speed/Torque" profile.

       "Custom I/O Connection" provides a freely definable I/O process data set.
    b) Set data type to the corresponding value (SINT, INT, DINT).

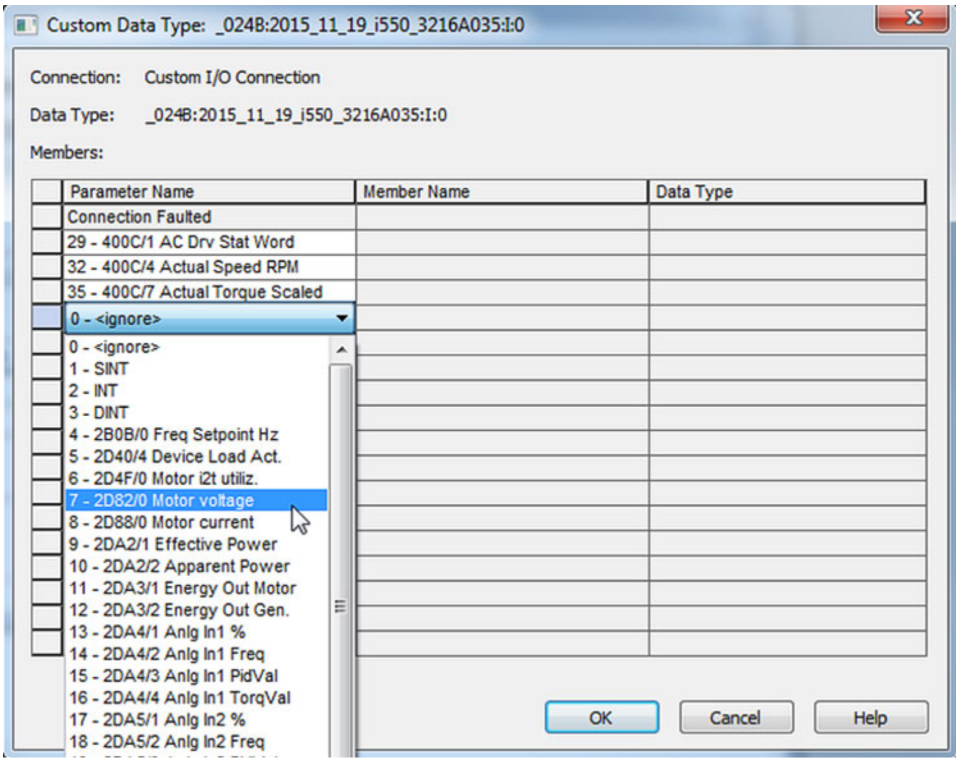
       The actual data length of each object mapped in the I/O data is determined by the inverter OBD object.

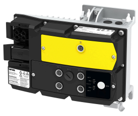
       INT and SINT prevent an uneven data length.

       DINT prevent an uneven number of data words.
11. Click "Input" in the line "Output" or "Change" to adapt the corresponding mapping individually.



This example shows a mapping selection for inputs:





12. Group the process data according to their data length to prevent gaps.

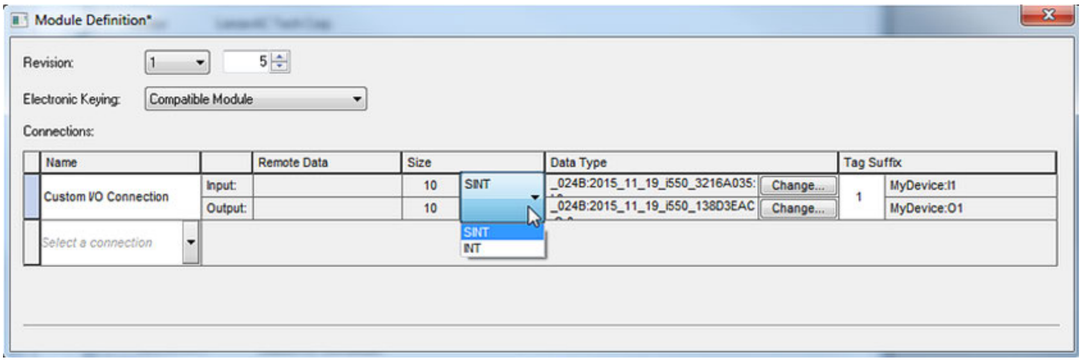
    Example:

    1. All required DINT data
    2. All required INT data
    3. All required SINT data

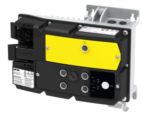
    At the end, a DINT value is automatically added to prevent tool zero-length problems.

    Data types are provided according to the input or output data length.

    Thus, e.g., no DINT type is provided at 10 bytes of input data:



The customer specific configuration is now completed.



Parameter configuration

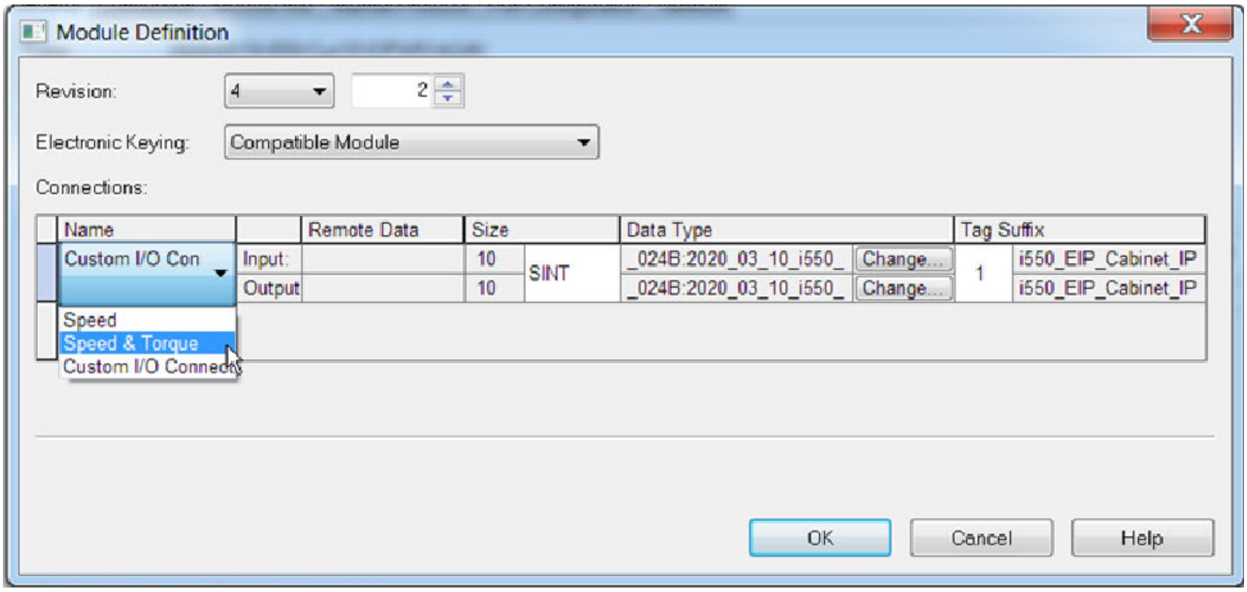
The configuration defines the parameters to be transmitted by means of the assembly objects 110 and 111.

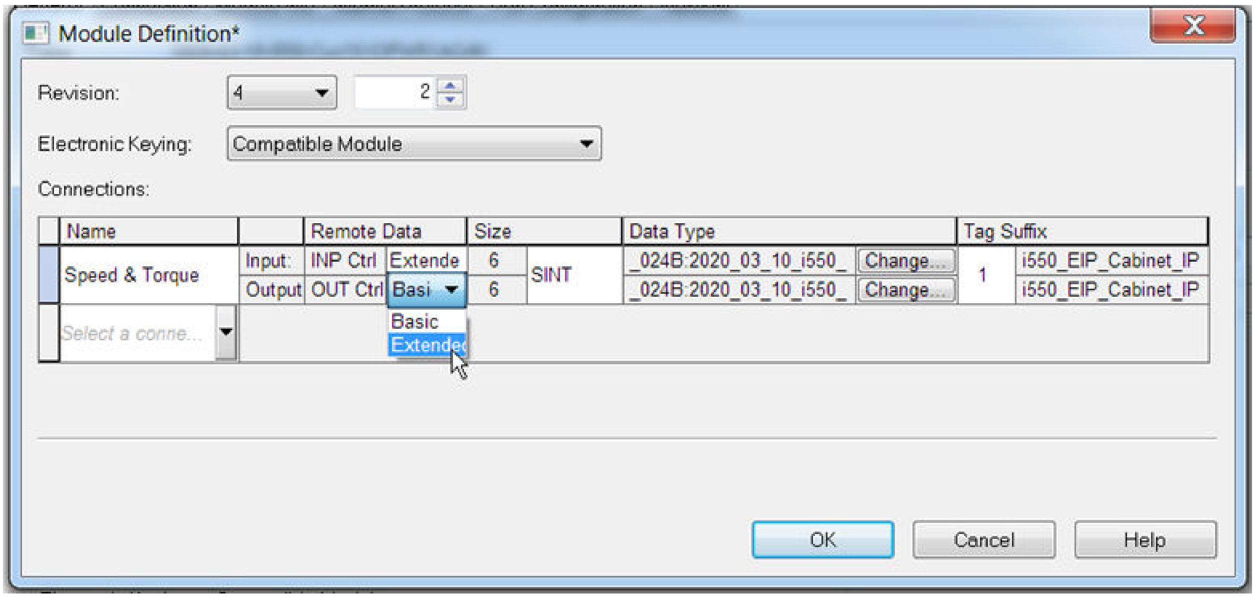
Information on the assembly objects: ▸ Supported CIP objects 📖 321

Two methods are available:

- Supporting scanners of class 1 can configure the data assignment in the inverter with the procedure described before.
- Alternatively, other masters can be used that do not support this data mapping for the user-defined assembly objects 110 and 111. However, the data assignment must be configured in the inverter itself.
- Internal mapping of the process output data (110): ...
- Internal mapping of the process input data (111): ...

The user can also set up the module for one of the predefined assembly configurations in the ODVA AC Drive profile:





In the example, the assembly input object 73 is used for reading status information of the inverter and the assembly output object 23 is used for controlling the inverter.

The assembly objects 73 (Extended Speed and Torque Control Input) and 23 (Extended Speed and Torque Control Output) can be used for most of the applications.

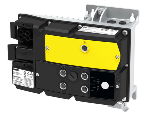
The inverter (adapter) must be in the same subnet as the PLC (scanner). The subnetwork corresponds to the first 3 bytes of the IP address.

The size of the assembly input and output objects must comply with the number of words that are actually used.

Bits 5 (NetCtrl) and 6 (NetRef) of byte 0 in the assembly output object 23 must be transmitted for the inverter in order that the control and speed reference commands are accepted by the network.

If the network control is active (0x400B:001/bit 5 = 1 and 0x2631:037 = 114), all bits of the AC drive control word (0x400B:001) are processed.

If the network control is not active (0x400B:001/bit 5 = 0 or 0x2631:037 = 0), the control bits 0, 1, 12, 13, 14, 15 are *not* processed. Their states are ignored and the drive is in local control.

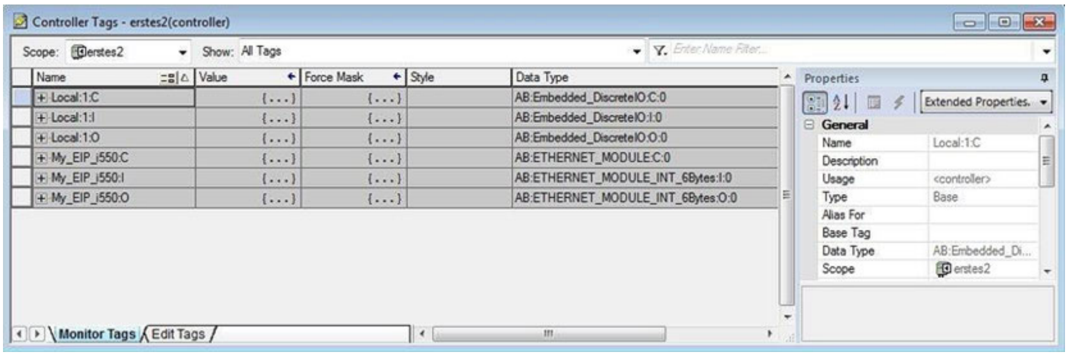


Further steps after setting up the module

1. Click "OK" in the "Module Definition" dialog.

   The network configuration of the inverter is now complete.

   In the navigation tree ("Controller Organizer") under "Controller → Controller Tags", assembly tags are generated.



   In the sample configuration with the "My_EIP_i550" inverter, these three assembly tags are generated:

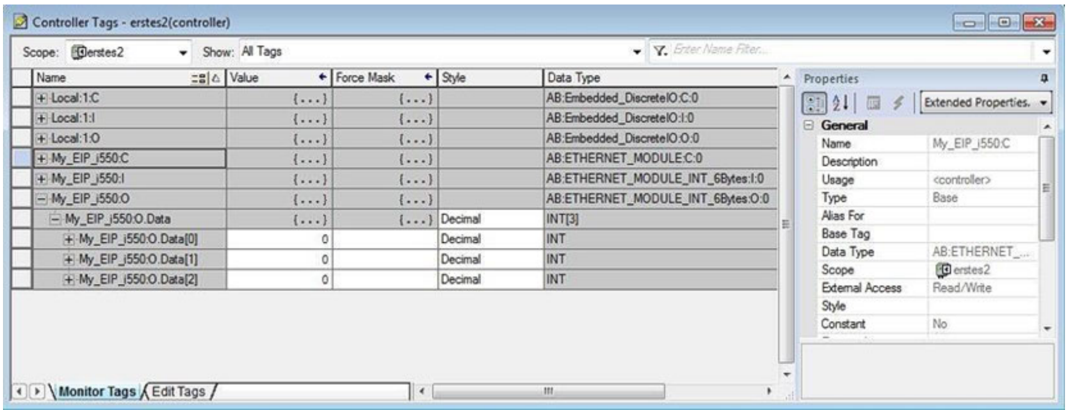
   "My_EIP_i550:C" for the configuration assembly

   "My_EIP_i550:I" for the input assembly

   "My_EIP_i550:O" for the output assembly

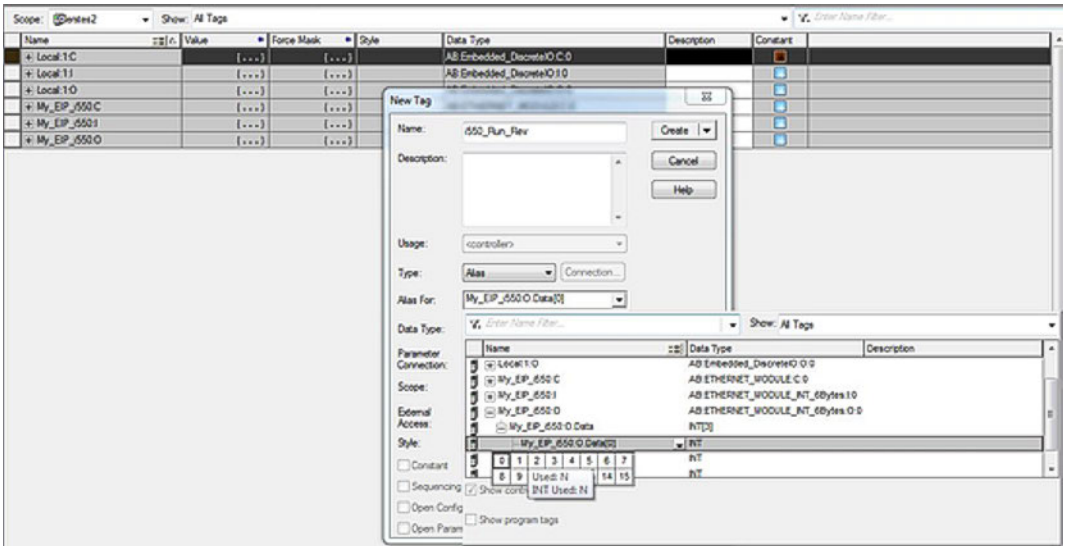
   By clicking [+] in front of the assembly names, the display of the assemblies is extended.

   Here, for instance, the four words are displayed, the output assembly "My_EIP_i550:O" consists of:



2. In the navigation tree (Controller Organizer) under "Controller", open the "Controller Tags".

3. Right-click any tag to execute the "New Tag" context menu command.
   The "New Tag" dialog box is opened.



4. Fill in input fields.

   In the example ...
   a) the name "i550_Run_Rev" is entered.
   b) the "Alias" type is selected.
   c) in the output assembly word "My_EIP_i550:O.Data[0]", bit 1 is assigned to "Run_Rev".
5. Click "Create".
   The new alias tag is added to the database.

The configuration is now completed.

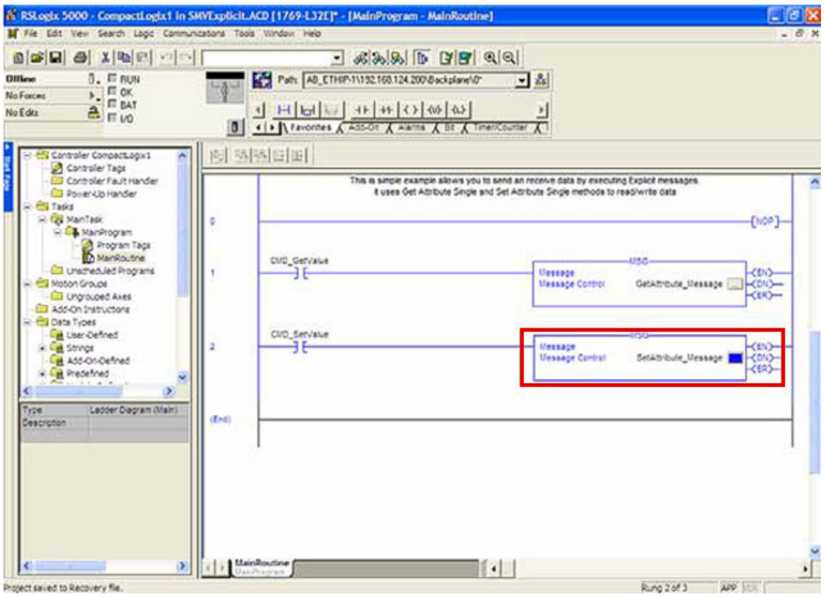
12.10.7 Parameter data transfer

- The acyclic/non-cyclic data access (service access) provides a procedure for the PLC (scanner) to access any drive or device parameter.
- This type of parameter access is typically used for ...
  - monitoring or the not time-controlled parameter access with low priority;
  - writing parameter data of the inverter (adapter).
- For this purpose, the inverter supports several methods.

Explicit Messaging

An explicit message is a logic instruction in the PLC program for the message transfer. It can be used to read or write a parameter setting or the data of an EtherNet/IP node (assembly data).

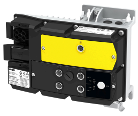
If the Allen-Bradley control systems»CompactLogix™«, »ControlLogix®« and »SoftLogix™« are used, the "Explicit Message" instruction provides the functionalities described in the following sections. Further PLC types can be found in the programming documentation of the PLC.



General drive variables (parameters and subindices) are contained in class "0x6E". The instance is the index number of the parameter and the attribute is the subindex number. If no subindex is available, the attribute must be set to "0". The attribute value "1" is only supported for those clients that do not support the attribute value "0".

All these variables have the data type SINT (8 bit, 1-byte objects), INT (16 bit, 2-byte objects) or DINT (32 bit, 4-byte objects).

The device parameters and the PLC program variables must have the same data lengths!

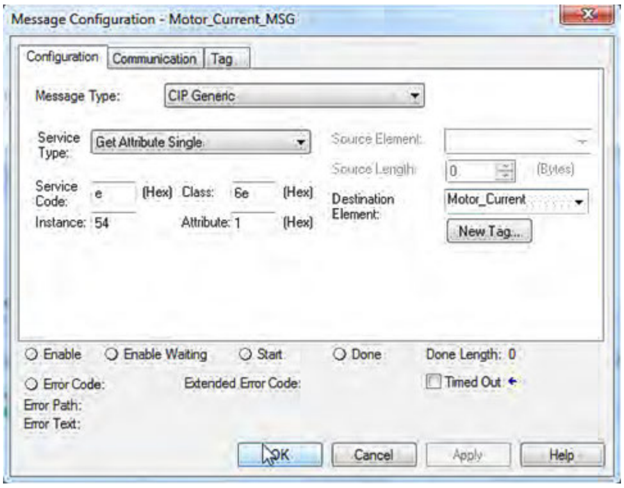


Read parameter value

Definitions to read a parameter value (Adapter → Scanner):

- Message Type = CIP Generic
- Service Code = 0x0E (read parameter, Get_Attribute_Single)
- Class= 0x6E (hex)
- Instance= index number of the parameter
- Attribute= parameter subindex number (or 0x01 in case of no subindex)
- Destination Element= target variable in the PLC (scanner) for the parameter data to be read.

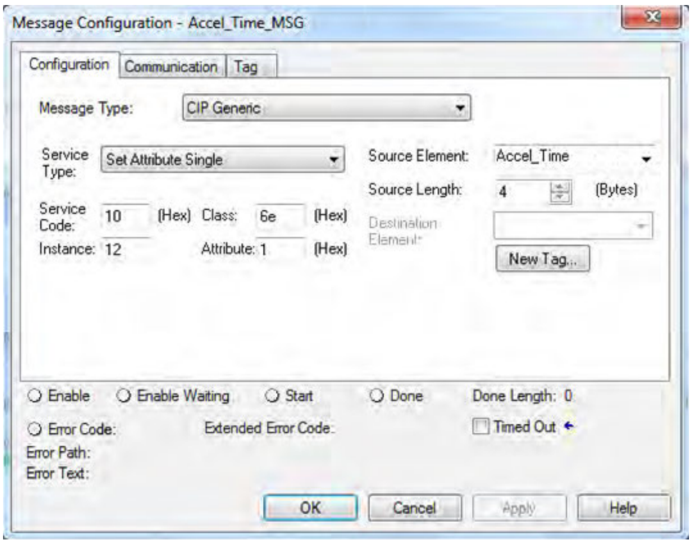
  The variable must have the same format and data length as the parameter!

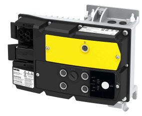


Write parameter value

Definitions to write a parameter value (Scanner → Adapter):

- Message Type = CIP Generic
- Service Code = 0x10 (write parameter, Set_Attribute_Single)
- Class= 0x6E
- Instance= index number of the parameter
- Attribute= parameter subindex number (or 0x01 in case of no subindex)
- Source Element = variable in the PLC (scanner) which is used as source of the parameter data to be written.
- Source Length= data length (bytes) of the data to be written





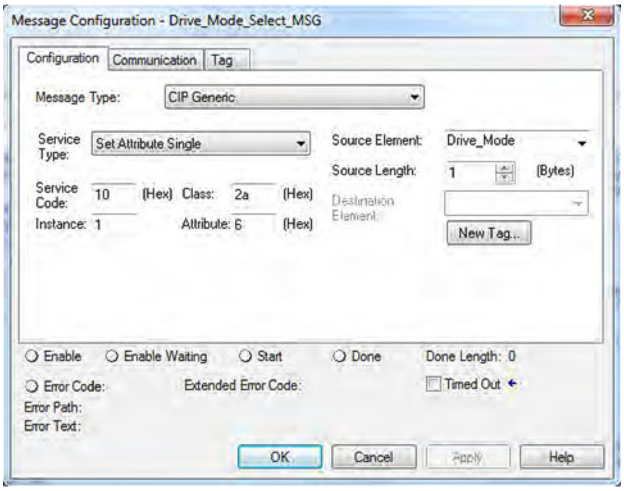
Write variables "TorqueScale" and "Drive_Mode"

The variables "TorqueScale" and "Drive_Mode" are AC drive profile objects

They are defined in the CIP library:

Variable	Class	Instance	Attribute	Data type	Size
Drive_Mode	2a	1	6	SINT	1 byte
TorqueScale	2a	1	18	SINT	1 byte

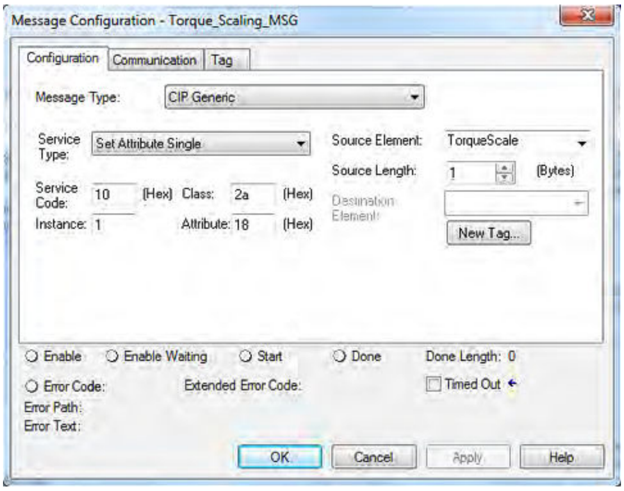
- Drive_Mode



The variable "Drive_Mode" has two valid settings:

- 1: Velocity Mode
- 3: Torque Mode

- TorqueScale

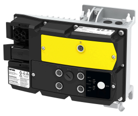


The variable "TorqueScale" refers to the real torque command by the following equation:

Torque reference in TorqueScale = Nm * 2TorqueScale

Due to the setting of TorqueScale = 0, the torque reference (assembly output object 23, bytes 4/5) is the real torque (= Nm * 20 = Nm * 1 = Nm).

Loading the value "2" as torque reference determines a torque limit of the drive of 2 Nm.



CIP Generic Master(read/write assembly data)

For "CIP Generic Master" that do not support the Implicit Messaging (class 1), the assembly data can be read or written via Explicit Messaging (class 3).

Definitions to read assembly data (Adapter → Scanner):

- Message Type = CIP Generic
- Service Code = 0x0E (read assembly data, Get_Attribute_Single)
- Class= 0x04
- Instance= assembly number in the desired device (e. g. 73 for assembly "73")
- Attribute= 0x03
- Destination Element= target array in the PLC (scanner) for the assembly data to be read.

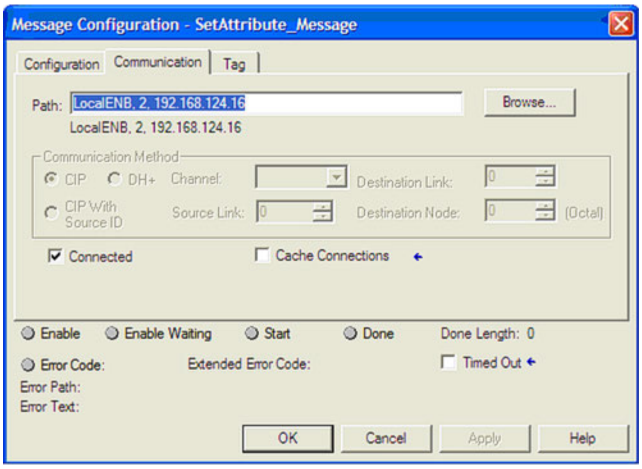
  The array must have the INT format and the same data length as the desired assembly!

Definitions to write assembly data (Scanner → Adapter):

- Message Type = CIP Generic
- Service Code = 0x10 (write assembly data, Set_Attribute_Single)
- Class= 0x04 (hex)
- Instance= assembly number in the desired device (e. g. 23 for assembly "23")
- Attribute= 0x03
- Source Element = INT array in the PLC (scanner), that is used as source of the assembly data to be written.
- Source Length= data length (bytes) of the INT array to be written (the assembly "23" contains e. g. 3 words which corresponds to 6 bytes.)

Explicit Message Path

For each explicit message, the path must be specified in order to forward the message from the Ethernet port of the PLC (scanner) to the IP address of the inverter (adapter). This path depends on the used PLC. If required, contact the PLC manufacturer to find out how the path is specified.

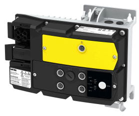


Explicit Messaging Timeout

In order to prevent that the inverter runs continuously, a time-out error state can be set.

For this purpose, set these parameters:

- 0x23A1:010: Timeout
- 0x2859:007: Timeout communication



12.10.8 Monitoring

The parameters for setting network monitoring functions are described below.

12.10.8.1 EtherNet/IP communication monitoring

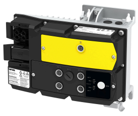
Parameter

Address	Name / setting range / [default setting]	Information
0x23A1:010	EtherNet/IP settings: Timeout 500 ... [**10000**] ... 65535 ms	Setting of the maximum permissible time-out for the CIP communication. When the specified monitoring time has elapsed, the response set in 0x2859:007 is triggered in the inverter.
0x23A1:011	EtherNet/IP settings: Inactivity timeout 0 ... [**120**] ... 3600 s	
0x2859:006	Network monitoring: Time-out explicit message	Selection of the response to time-outs during the transfer of Explicit Messages. Associated error code: • 33042 | 0x8112 - Network - Time-out explicit message
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	
0x2859:007	Network monitoring: Timeout communication	Selection of the response to the time-out during the CIP communication. The monitoring time for the CIP communication is defined in 0x23A1:010. Associated error code: • 33044 | 0x8114 - Network - Overall communication time-out
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	
0x2859:001	Network monitoring: Watchdog elapsed	Selection of the response to a permanent interruption of the communication to the IO controller. Associated error code: • 33168 | 0x8190 - Network - Watchdog time-out
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	

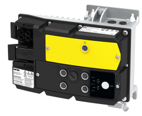
12.10.8.2 Other monitoring

Parameter

Address	Name / setting range / [default setting]	Information
0x2859:003	Network monitoring: Invalid configuration	Selection of the response triggered by the reception of invalid configuration data. Associated error code: • 33414 | 0x8286 - Network - PDO mapping error
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	



Address	Name / setting range / [default setting]		Information
0x2859:004	Network monitoring: Initialisation error		Selection of the response triggered by the occurrence of an error during the initialization of the network component. Associated error code: • 33170 | 0x8192 - Network - Initialization error
	0	No response	▶ Error types 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	
0x2859:005	Network monitoring: Invalid process data		Selection of the response triggered by the reception of invalid process data. Process data marked as invalid (IOPS is "BAD") are received by the IO Controller. Typically in case of • a PLC in STOP state, • alarms, • acyclic demand data. Associated error code: • 33171 | 0x8193 - Network - Invalid cyclic process data
	0	No response	▶ Error types 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	



12.10.9 Diagnostics

12.10.9.1 LED status display

The "MS" LED indicate the CIP module status.

LED "MS" (green/red)	CIP module status	Status/meaning
off	Nonexistent	The network option is not supplied with voltage.
On (green)	Operational	The network option works correctly.
Blinking green	Standby	The network option is not configured completely or the configuration is incorrect.
Blinking red	Major recoverable fault	The network option contains a correctable error.
on (red)	Major unrecoverable fault	The network option contains a non-correctable error.
Blinking green/red	Device self testing	The network option executes a self-test.

The "NS" LED indicate the CIP network status.

LED "NS" (green/red)	CIP network status	Status/meaning
off	No IP address	The network option is not supplied with voltage or has not received an IP address yet.
On (green)	Connected	The network option works correctly and has established a connection to the scanner.
Blinking green	No connections	The network option • works correctly, • has been assigned to an IP address, • has not been implemented into the network yet by the scanner.
Blinking red	Connection timeout	A time-out has occurred.
on (red)	Duplicate IP	The network option cannot access the network (IP address conflict).
Blinking green/red	Device self testing	The network option executes a self-test.

The "L/A" LEDs indicate the connection status of ports X396 and X397.

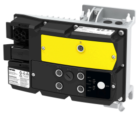
LED "L/A"	Status	Meaning
off	Not connected	Network not available
on	Connected	Network available No data transfer
blinking	Traffic	Data transfer

12.10.9.2 Information on the network

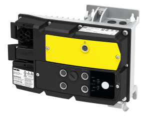
The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x23A2:001	Active EtherNet/IP settings: IP address • Read only	Display of the active IP address.
0x23A2:002	Active EtherNet/IP settings: Subnet • Read only	Display of the active subnet mask.
0x23A2:003	Active EtherNet/IP settings: Gateway • Read only	Display of the active gateway address.
0x23A2:005	Active EtherNet/IP settings: MAC address • Read only	Display of the active MAC address.
0x23A2:006	Active EtherNet/IP settings: Multicast address • Read only	Display of the active Multicast IP address.



Address	Name / setting range / [default setting]		Information
0x23A5:001	Active port settings: Port 1 (X266) • Read only		
	0	Not connected	
	1	10 Mbps/Half Duplex	
	2	10 Mbps/Full Duplex	
	3	100 Mbps/Half Duplex	
	4	100 Mbps/Full Duplex	
	5	Reserved	
	6	Reserved	
	7	Port disabled	
0x23A5:002	Active port settings: Port 2 (X267) • Read only		
	0	Not connected	
	1	10 Mbps/Half Duplex	
	2	10 Mbps/Full Duplex	
	3	100 Mbps/Half Duplex	
	4	100 Mbps/Full Duplex	
	5	Reserved	
	6	Reserved	
	7	Port disabled	
0x23A6	Quality of service		Display if the QoS tag for prioritising the data packages to be transmitted is used.
	0	**802.1Q Tag disable**	
	1	802.1Q Tag enable	
0x23A8	CIP module status • Read only		Display of the active CIP module status.
	0	Nonexistent	
	1	Device self testing	
	2	Standby	
	3	Operational	
	4	Major recoverable fault	
	5	Major unrecoverable fault	
0x23A9	EtherNet/IP status • Read only		Display of the active network status.
	0	No IP address	
	1	No connections	
	2	Connected	
	3	Connection timeout	
	4	Duplicate IP	
	5	Device self testing	



12.11 Modbus TCP

Modbus is an internationally approved, asynchronous, serial communication protocol, designed for commercial and industrial automation applications.

- Detailed information on the Modbus can be found on the web page of the international Modbus Organization, USA, who also further develop the Modbus protocol: http://www.modbus.org
- Information about the dimensioning of a Modbus network can be found in the configuration document for the inverter.

Preconditions

In 0x231F:005 the network selection is set to "Modbus TCP".

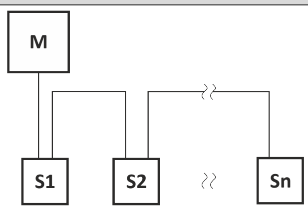
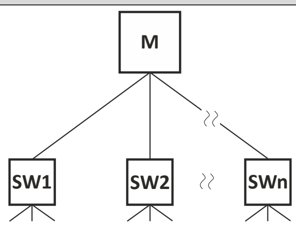
Modbus TCP connection

The connection is made via the M12 connectors **X396** (IN) and **X397** (OUT).

Details

- The process of data transmission distinguishes between three different operating modes: Modbus ASCII, Modbus RTU and Modbus TCP/IP. This chapter describes the Modbus TCP/IP operating mode.
- The Modbus protocol is based on a master/slave architecture where the inverter always works as slave.
- In the Modbus TCP/IP network, a master can only address one slave at a time. However, several masters can be available in the network.
- Only a master can initiate the Modbus communication.
- No direct communication takes place between the slaves.
- The network option supports the baud rates 10 Mbps (10 BaseT) and 100 Mbps (100 BaseT). The baud rate in the network is automatically detected.
- The inverter supports the function codes 3, 6, 16 (0x10) and 23 (0x17).

Typical topologies

Line	Tree
	

M	Master	SW	Switch
S	Slave		

12.11.1 Commissioning

In the following, the steps required for controlling the inverter via Modbus are described.

Parameterization required

1. Activate network control: 0x2631:037 = "TRUE [1]"
2. Set network as standard setpoint source: 0x2860:001 ="Network [5]"
3. Implement the IP settings of the inverter (slave).

   See: ▸ IP settings 🕮 359
4. Set Modbus baud rate.
   - Default setting: Automatic detection.
   - See: ▸ Baud rate setting 🕮 360
5. Save parameter settings: 0x2022:003 = "on / start [1]".
6. Switch the inverter off and then on again in order that the changed communication settings can get effective.

In the default setting, the "Run" function is assigned to digital input DI1. If network control is activated, this function serves as the "start enable" for starting commands via the network. Hence, digital input DI1 must be set to the HIGH level so the motor can be started via the network.

▸ Flexible I/O configuration of the start, stop and rotating direction commands 🕮 52

Starting/stopping the drive via Modbus

For starting/stopping the drive, Modbus register 42101 can be used.

- The Modbus register 42101 is permanently assigned to the parameter 0x400B:001 (AC Drive control word).
- In the frame, the leading 4 is omitted in the addressing process. The numbering of the registers starts with 1; addressing, however, starts with 0. Therefore the address 2100 (0x0834) is used in the frame when register 42101 is written.

Bits set in the AC Drive control word:

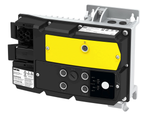
- Bit 0 = Run forward (CW)
- Bit 5 = Activate network control
- Bit 6 = Activate network setpoint
- Function code 6, i. e. writing into a single register.

Example of an inverter with the node address 1:

Request frame by the master					
Unit identifier	Function code	Register address		AC Drive control word Data: 0b1100001 ≡ 0x0061	
0x01	0x06	0x08	0x34	0x00	0x61

If the digital input DI1 ("Start enable") is set to HIGH level, the drive should start and the inverter should respond with the same frame as confirmation:

Response message from the inverter					
Unit identifier	Function code	Register address		AC Drive control word Data: 0b1100001 ≡ 0x0061	
0x01	0x06	0x08	0x34	0x00	0x61



Write the speed of the drive via Modbus

The drive speed can be changed via the modbus register 42102, see:

▶ Data mapping 📖 368

Example of an inverter with the node address 1:

Request frame by the master					
Unit identifier	Function code	Data			
		Register address		Network setpoint frequency (0.01)	
0x01	0x06	0x08	0x35	0x04	0xD2

Response message from the inverter					
Unit identifier	Function code	Data			
		Register address		Network setpoint frequency (0.01)	
0x01	0x06	0x08	0x35	0x04	0xD2

The drive now rotates with a frequency of 12.34 Hz.

Read the drive speed via Modbus

The drive speed can be read via the Modbus register 42002, see:

▶ Data mapping 📖 368

The function code 3 is used to read a single register or several interrelated register blocks, see:

▶ Function codes 📖 362

Example of an inverter with the node address 1:

Request frame by the master					
Unit identifier	Function code	Data			
		Register address		Number of words	
0x01	0x03	0x07	0xD1	0x00	0x01

Response message from the inverter				
Unit identifier	Function code	Data		
		Read bytes	Frequency (0.01)	
0x01	0x03	0x02	0x04	0xD1

The drive rotates with a frequency of 12.33 Hz.

Restart of the communication

A restart of communication is required after changes of the interface configuration (e. g. node address and baud rate) in order that the changed settings become effective.

For restarting communication, there are two options:

a) Switch inverter off and on again.

b) 0x23B0 Set = "Restart with current values [1]".

Parameter

Address	Name / setting range / [default setting]		Information
0x23B0	Modbus TCP communication		Restart / stop communication
	0	**No action/no error**	Only status feedback.
	1	Restart with current values	Restart communication in order that changed settings of the interface configuration become effective.
	2	Restart with default values	Restart communication with the standard values.
	5	Stop network communication	Stop communication.
	10	In progress	Only status feedback
	11	Action cancelled	
	12	Fault	

12.11.2 Basic setting and options

12.11.2.1 IP settings

IP basic settings

The basic IP settings are required to let the engineering software access the network nodes (PLC, inverter) directly via Ethernet.

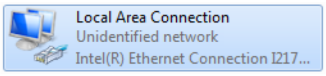
The PC with the engineering software must be in the same network as the devices to be configured.

First, configure the PC so that this condition is fulfilled.

The required steps are described by the example of the operating system Microsoft® Windows® 7.

How to define the IP basic settings:

1. Call the "Network and sharing center" under "Control panel".
2. Select "Change adapter settings" (observe administrator rights!).
3. Select the network to be configured (double-click), e. g.:



> The network nodes (PLC, inverter) must be connected to the network.

The status dialog box of the network is opened.

4. Click "Properties".
   The properties dialog box of the network is opened.
5. Select "Internet protocol version 4 (TCP/IPv4)" and click "Properties".
   The properties dialog box of the "Internet protocol version 4 (TCP/IPv4)" is opened.
6. Enter the IP address, the subnet mask and, if required, the gateway address under "Use the following addresses".
7. Click "OK".

The IP basic settings are now completed.

Set IP address

The IP address is set in 0x23B1:001.

- 0x23B2:001 shows the active IP address.
- A value changed during operation only becomes valid with a network restart.

Time-To-Live (TTL)

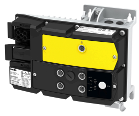
The TTL value (8-bit value) limits the number of routers a sent package passes on the way to its target.

- 0x23A1:006: Time-to-live value (TTL)

The parameters for the IP settings of the inverter are described below.

Parameter

Address	Name / setting range / [default setting]	Information
0x23B1:001	Modbus -TCP/IP settings: IP address 0.0.0.0 ... [**192.168.124.16**] ... 255.255.255.255	Set IP address. The default setting 276605120 corresponds to the IP address 192.168.124.16. • 276605120 = 0x107CA8C0 → 0xC0.0xA8.0x7C.0x10 = 192.168.124.16
0x23B1:002	Modbus -TCP/IP settings: Subnet 0.0.0.0 ... [**255.255.255.0**] ... 255.255.255.255	Set subnet mask. The default setting 16777215 corresponds to the subnet mask 255.255.255.0. • 16777215 = 0xFFFFFF → 0xFF.0xFF.0xFF.0x00 = 255.255.255.0



Address	Name / setting range / [default setting]	Information
0x23B1:003	Modbus -TCP/IP settings: Gateway 0.0.0.0 ... [**0.0.0.0**] ... 255.255.255.255	Set gateway address. Example The setting 276344004 corresponds to the gateway address 196.172.120.16. • 276344004 = 0x1078ACC4 → 0xC4.0xAC.0x78.0x10 = 196.172.120.16
0x23B1:005	Modbus -TCP/IP settings: IP configuration	Set IP configuration.
	0 **Stored IP**	The currently saved IP configuration is used.
	1 BOOTP	The IP configuration is assigned by the client via BOOTP.
	2 DHCP	The IP configuration is assigned by the client via DHCP. The assignment of a gateway address that is not in the same subnetwork as the IP address, is denied.
0x23B1:006	Modbus -TCP/IP settings: Time-to-live value (TTL) 1 ... [**32**] ... 255	Setting of the TTL value for the validity of data packages in the network.
0x23B1:011	Modbus -TCP/IP settings: Secondary port 0 ... [**502**] ... 65535	Set port number for a second port.

12.11.2.2 Baud rate setting

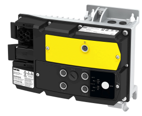
- Set the baud rate for port 1 in 0x23B4:001 and for port 2 in 0x23B4:002.
- The automatic detection of the baud rate is preset for the ports.
- The active baud rate is displayed for port 1 in 0x23B5:001 and for port 2 in 0x23B5:002.

Parameter

Address	Name / setting range / [default setting]	Information
0x23B4:001	Port settings: Port 1	
	0 **Auto-Negotiation**	
	1 10 Mbps	
	2 100 Mbps	
	5 10 Mbps/Half Duplex	
	6 10 Mbps/Full Duplex	
	7 100 Mbps/Half Duplex	
	8 100 Mbps/Full Duplex	
0x23B4:002	Port settings: Port 2	
	0 **Auto-Negotiation**	
	1 10 Mbps	
	2 100 Mbps	
	5 10 Mbps/Half Duplex	
	6 10 Mbps/Full Duplex	
	7 100 Mbps/Half Duplex	
	8 100 Mbps/Full Duplex	

12.11.3 Data transfer

The mode of access to inverter data (parameters) is controlled via function codes.



12.11.3.1 Function codes

The inverter supports the following function codes:

Function code		Function name	Info
3	0x03	Read Holding Registers	Reading of a single register or a group of several interconnected registers.
6	0x06	Preset Single Register	Writing of a single register.
16	0x10	Preset Multiple Registers	Writing of a single register or a group of several interconnected registers.
23	0x17	Read/Write 4X Registers	Reading and writing within a transaction: • Writing of a data block into a group of several interconnected registers. • Reading from a block of interconnected registers.

Frame structure

Modbus Application Header (MBAP)				Protocol Data Unit (PDU)	
Transaction number	Protocol characters (always 0x0000)	Number of the bytes still to follow	Unit identifier	Function code	Data / error code
2 bytes	2 bytes	2 bytes	1 byte	1 byte	n byte

Tab. 1: ADU (Application Data Unit)

Communication is established on the basis of the master/slave mode. Communication is always started by a master request.

The inverter (slave) then either gives a valid response or outputs an error code (provided that the request has been received and evaluated as valid message).

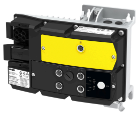
In case of a valid answer, the function code is returned. In the event of an error, a function code assigned to the request is returned.

Error causes can be invalid CRC checksums, non-supported function codes or impermissible data accesses.

Elements of the ADU:

- MBAP (7 bytes)
  - Number of the bytes still to follow in the message.
  - Address of the inverter.
  - The other bytes of the header are not described here.
- Function code
  - The function codes exclusively refer to "4X registers", i. e. registers from the address 4000.
  - All data in the inverter can only be accessed via these 4X registers, see: Data mapping 🕮 368
  - The 4xxxx reference is implicit, i. e. given by the function code used. In the frame therefore the leading 4 is omitted in the addressing process.
  - Lenze supports the basic 1 addressing of Modbus, i.e. the numbering of the registers starts with 1 whereas addressing starts with 0. For example, the address 0 is used in the frame when register 40001 is read.
- Data or error code
- Checksum

All ADU contents are represented in the Big Endian format (most significant byte first).



Error codes

In the event of an error, the Modbus node responds with a function code associated with the message:

Function code	Associated function code in the event of an error	Supported error codes
0x03	0x83	0x01, 0x02, 0x03, 0x04
0x06	0x86	0x01, 0x02, 0x03, 0x04
0x10	0x90	0x01, 0x02, 0x03, 0x04
0x17	0x97	0x01, 0x02, 0x03, 0x04

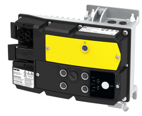
Error code	Designation	Cause(s)
0x01	Invalid function code	The function code is not supported by the inverter, or the inverter is in a state in which the request is not permissible or in which it cannot be processed.
0x02	Invalid data address	The combination of a start address and the length of the data to be transmitted is invalid. Example: If you have a slave with 100 registers, the first register has the address 0 and the last register has the address 99. If there is a request of four registers now, from the start address 96, the request can be processed successfully (for registers 96, 97, 98, and 99). If, however, five registers from the start address 96 are queried, this error code is returned, since the slave has no register with the address 100.
0x03	Invalid data value	Error in the reset structure of a complex request, e. g. because the data length that has resulted implicitly is not correct. The cause, however, is not that a (parameter) value is written outside the valid setting range. As a matter of principle, the Modbus protocol has no information on valid setting ranges of single registers or their meaning.
0x04	Slave device failure	A non-correctable error has occurred while the request was processed in the inverter.

Data transfer with function code 3

Request	
Function code	0x03
Start address	0x0000 ... 0xFFFF
Number of registers (n)	0x01 ... 0x7D (1 ... 125)

Response	
Function code	0x03
Number of bytes	2 x (number of registers)
Register value	Data in (n) register of 2 bytes each

Error message	
Function code in the event of an error	0x83
Error code	01 ... 04



Example for data transfer with function code 3

The data from the registers 40108 to 40110 are to be read.

Request		**Info**
Function code	0x03	Function code 3
Start address (High)	0x00	Start address 107 (0x006B)
Start address (Low)	0x6B	
Number of registers (High)	0x00	Number of registers = 3 (0x0003)
Number of registers (Low)	0x03	

Response		**Info**
Function code	0x03	Function code 3
Number of bytes	0x06	6 bytes are read.
Value in registers 40108 (High)	0x02	Data in register 40108: 0x022B (555).
Value in registers 40108 (Low)	0x2B	
Value in registers 40109 (High)	0x00	Data in register 40109: 0x0000 (0).
Value in registers 40109 (Low)	0x00	
Value in registers 40110 (High)	0x00	Data in register 40110: 0x0064 (100).
Value in registers 40110 (Low)	0x64	

Data transfer with function code 6

Request	
Function code	0x06
Register address	0x0000 ... 0xFFFF
Register value	0x0000 ... 0xFFFF

Response	
Function code	0x06
Register address	0x0000 ... 0xFFFF
Register value	0x0000 ... 0xFFFF

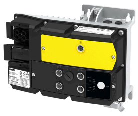
Error message	
Function code in the event of an error	**0x86**
Error code	01 ... 04

Example for data transfer with function code 6

The value "3" (0x0003) is to be written into the register 40002.

Request		**Info**
Function code	0x06	Function code 6
Register address (High)	0x00	Register address for register 40002: 1 (0x0001)
Register address (Low)	0x01	
Register value (High)	0x00	Value to be written into the register: 3 (0x0003)
Register value (Low)	0x03	

Response		**Info**
Function code	0x06	Function code 6
Register address (High)	0x00	Register address: 1 (0x0001)
Register address (Low)	0x01	
Register value (High)	0x00	Register value: 3 (0x0003)
Register value (Low)	0x03	



Data transfer with function code 16

Request	
Function code	0x10
Start address	0x0000 ... 0xFFFF
Number of registers (n)	0x0001 ... 0x7D (0d125)
Number of bytes	2 x (number of registers)
Register values	Data in (n) register of 2 bytes each

Response	
Function code	0x10
Number of bytes	2 x (number of registers)
Register values	Data in (n) register of 2 bytes each

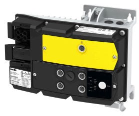
Error message	
Function code in the event of an error	**0x90**
Error code	01 ... 04

Example for data transfer with function code 16

In a transaction, the value "10" is to be written into the register 40002 and the value "258" is to be written into the adjacent register 40003.

Request		**Info**
Function code	0x10	Function code 16
Start address (High)	0x00	Start address is the register 40002: 1 (0x0001)
Start address (Low)	0x01	
Number of registers (High)	0x00	Number of registers: 2 (0x0002)
Number of registers (Low)	0x02	
Number of bytes	0x04	4 bytes (0x0004) are to be written.
Register value (High)	0x00	The value "10" (0x000A) is written into the register with the start address 1 (= register 40002).
Register value (Low)	0x0A	
Register value (High)	0x01	The value "258" (0x0102) is written into the following register (= register 40003).
Register value (Low)	0x02	

Response		**Info**
Function code	0x10	Function code 16
Start address (High)	0x00	Start address: 1 (0x0001)
Start address (Low)	0x01	
Number of registers (High)	0x00	Number of registers: 2 (0x0002)
Number of registers (Low)	0x02	

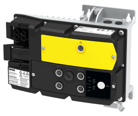


Data transfer with function code 23

Request	
Function code	**0x17**
Start address for reading (High)	0x0000 ... 0xFFFF
Start address for reading (Low)	0x0000 ... 0xFFFF
Number of registers for reading (High)	0x00 ... 0xFF
Number of registers for reading (Low)	0x00 ... 0xFF
Start address for writing (High)	0x0000 ... 0xFFFF
Start address for writing (Low)	0x0000 ... 0xFFFF
Number of registers for writing (High)	0x00 ... 0xFF
Number of registers for writing (Low)	0x00 ... 0xFF
Number of bytes for writing	2 x (number of registers)
Written value 1 (High)	0x00 ... 0xFF
Written value 1 (Low)	0x00 ... 0xFF
....	...
Written value n (High)	0x00 ... 0xFF
Written value n (Low)	0x00 ... 0xFF

Response	
Function code	**0x17**
Number of bytes for reading	2 x (number of registers)
Read value 1 (High)	0x00 ... 0xFF
Read value 1 (Low)	0x00 ... 0xFF
...	...
Read value x (High)	0x00 ... 0xFF
Read value x (Low)	0x00 ... 0xFF

Error message	
Function code in the event of an error	**0x97**
Error code	02 ... 04



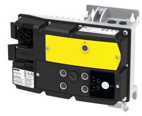
Example for data transfer with function code 23

The following tasks are to be executed with a transaction:

- The values from six connected registers, starting with register 40005, are to be read.
- The value "255" is to be written into each of three connected registers, starting with register 40016.

Request		Info
Function code	0x17	Function code 23
Start address for reading (High)	0x00	Start address for reading is the register 40005: 4 (0x0004)
Start address for reading (Low)	0x04	
Number of registers for reading (High)	0x00	Number of registers for reading: 6 (0x0006))
Number of registers for reading (Low)	0x06	
Start address for writing (High)	0x00	Start address for writing is the register 40016: 15 (0x000F)
Start address for writing (Low)	0x0F	
Number of registers for writing (High)	0x00	Number of registers for writing: 3 (0x0003)
Number of registers for writing (Low)	0x03	
Number of bytes for writing	0x06	6 bytes (0x06) must be provided in 3 registers.
Written value 1 (High)	0x00	Data: 255 (0x00FF)
Written value 1 (Low)	0xFF	
Written value 2 (High)	0x00	Data: 255 (0x00FF)
Written value 2 (Low)	0xFF	
Written value 3 (High)	0x00	Data: 255 (0x00FF)
Written value 3 (Low)	0xFF	

Response		Info
Function code	0x17	Function code 23
Number of bytes for reading	0x0C	12 bytes (0x0C) from 6 registers are read.
Read value 1 (High)	0x00	1. written value Data: 254 (0x00FE)
Read value 1 (Low)	0xFE	
Written value 2 (High)	0x0A	2. written value Data: 2765 (0x0ACD)
Read value 2 (Low)	0xCD	
Read value 3 (High)	0x00	3. read value Data: 1 (0x0001)
Read value 3 (Low)	0x01	
Read value 4 (High)	0x00	4. read value Data: 3 (0x0003)
Read value 4 (Low)	0x03	
Read value 5 (High)	0x00	5. read value Data: 13 (0x000D)
Read value 5 (Low)	0x0D	
Read value 6 (High)	0x00	6. read value Data: 255 (0x00FF)
Read value 6 (Low)	0xFF	



12.11.3.2 Data mapping

The process of data mapping is used for defining which Modbus registers read or write to which inverter parameters.

- There are pre-defined Modbus registers for common control and status words, which are located in coherent blocks, in order to facilitate communication with OPC servers and other Modbus masters. In order to access all relevant data of the inverter, only a minimum number of commands is required.
- In addition, 24 registers are provided for variable mapping, i. e. free assignment to inverter parameters.

Overview

The following table provides an overview of the Modbus register with variable and permanent assignment:

Register	Register address	Info
40103	0102	Variable mapping 0x23BB:001 ... 0x23BB:024 serves to map these 24 registers to parameters of the inverter.
40104	0103	
...	...	
40149	0148	
42001 ... 42021	2000 ... 2020	Predefined Modbus status registers For details see the following section "Predefined Modbus status registers".
42101 ... 42121	2100 ... 2120	Predefined Modbus control registers For details see the following section "Predefined Modbus control registers".

Predefined Modbus control registers

- These registers are provided with write and read access.
- The cross-reference in column 2 leads to the detailed parameter description.

Modbus registers	Permanently assigned parameter	
	Address	Designation
42101	0x400B:001	AC Drive control word
42102	0x400B:005	Network setpoint frequency (0.01)
42103	0x4008:002	NetWordIN2
42104		NetWordIN3
42105	0x400B:007	PID setpoint
42106	0x6071	Set torque
42107	0x4008:001	NetWordIN1
42108		NetWordIN4
42109 ... 42121	-	Reserved

Predefined Modbus status registers

- These registers are only provided with read access.
- The cross-reference in column 2 leads to the detailed parameter description.

Modbus registers	Permanently assigned parameter	
	Address	**Designation**
42001	0x400C:001	AC Drive status word
42002	0x400C:006	Frequency (0.01)
42003	0x603F	Error code
42004	0x400C:005	Drive status
42005	0x2D89	Motor voltage
42006	0x2D88	Motor current
42007	0x6078	Actual current
42008	0x2DA2:002	Apparent power (42008 = High Word, 42009 = Low Word)
42009		
42010	0x2D84:001	Heatsink temperature
42011	0x2D87	DC-bus voltage
42012	0x60FD	Digital input status (only bit 16 ... bit 31)
42013	0x6077	Actual torque
42014 ... 42021	-	Reserved

Variable mapping

- Via 0x23BB:001 ... 0x23BB:024, 24 registers can be mapped to parameters of the inverter. Format:
  0xiiiiss00
  (iiii = index,
  ss = subindex)
- The display of the internal Modbus register numbers in 0x23BC:001 ... 0x23BC:024 is generated automatically. Since 32-bit parameters require two registers, there is no 1:1 assignment.
- For the mappable registers, a CRC (Cyclic Redundancy Check) is executed. The checksum determined is displayed in 0x23BD. The user can read this "validation code" and use it for comparison in the Modbus master. In this way it can be checked whether the inverter currently queried is configured correctly for the respective application.

Parameter

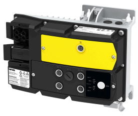
Address	Name / setting range / [default setting]	Information
0x23BB:001 ... 0x23BB:024	Modbus TCP/IP parameter mapping: Parameter 1 ... Parameter 24 0x00000000 ... [**0**] ... 0xFFFFFFFF	Mapping entries for the variable mapped Modbus registers. • Format: 0xiiiiss00 (iiii = index, ss = subindex)
0x23BC:001 ... 0x23BC:024	Register assignment: Register 1 ... Register 24 • Read only	Display of the internal Modbus register number starting from which the parameter mapped in 0x23BB:001 ... 0x23BB:024 is stored. • For the first parameter mapped, always 2500. • From the second parameter mapped, 2500 + offset. The offset results from the data types of the previously mapped parameters.
0x23BD	Verification code • Read only	

12.11.4 Monitoring

The parameters for setting network monitoring functions are described below.

Parameter

Address	Name / setting range / [default setting]	Information
0x23B1:010	Modbus -TCP/IP settings: Ethernet time-out 0 ... [**10**] ... 65535 s	Setting of the maximum permissible time-out of the TCP communication. When the specified monitoring time has elapsed, the response set in 0x2859:007 is triggered in the inverter.



Address	Name / setting range / [default setting]	Information
0x23B6:001	Time-out monitoring: Time-out time 0.0 ... [**2.0**] ... 300.0 s	Monitoring is active if the first valid write command arrives at the Modbus client. Each further valid write/read message resets the watchdog timer. Monitoring responds if within the time set here no valid message has been received by the Modbus client.
0x23B6:002	Time-out monitoring: Keep alive time-out time 0.0 ... [**2.0**] ... 300.0 s	Monitoring is active after a valid value is written into the keep alive register 0x23B6:005 via the Modbus for the first time. Keep alive monitoring responds if no value (range 1 ... 65535) has been written into the keep alive register within the time set here.
0x23B6:005	Time-out monitoring: Keep alive register 0 ... [**0**] ... 65535	Time-out monitoring of the keep alive register is active after a value has been written into the keep alive register for the first time. In order to prevent that time-out monitoring for the keep alive register responds, the keep alive register must be written as follows: • With a value of 1 ... 65535 **and** • an interval that is shorter than the time set in 0x23B6:002.
0x2859:008	Network monitoring: Fault reaction by time-out Master	Selection of the response if within the time set in 0x23B6:001 no valid message has arrived at the Modbus client. Associated error code: • 33046 | 0x8116 - Modbus TCP master time-out
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	
0x2859:009	Network monitoring: Fault reaction by time-out Keep alive	Selection of the response if within the time set in 0x23B6:002 no valid message has been written into the keep alive register. Associated error code: • 33047 | 0x8117 - Modbus TCP Keep Alive time-out
	0 No response	▸ Error types 📖 444
	11 Information	
	12 Warning	
	16 Trouble	
	23 Fault	

12.11.5 Diagnostics

12.11.5.1 LED status display

The "MS" LED indicate the CIP module status.

LED "MS" (green/red)	CIP module status	Status/meaning
off	Nonexistent	The network option is not supplied with voltage.
On (green)	Operational	The network option works correctly.
Blinking green	Standby	The network option is not configured completely or the configuration is incorrect.
Blinking red	Major recoverable fault	The network option contains a correctable error.
on (red)	Major unrecoverable fault	The network option contains a non-correctable error.
Blinking green/red	Device self testing	The network option executes a self-test.

The "NS" LED indicate the CIP network status.

LED "NS" (green/red)	CIP network status	Status/meaning
off	No IP address	The network option is not supplied with voltage or has not received an IP address yet.
On (green)	Connected	The network option works correctly an has established a connection to the master.
Blinking green	No connections	The network option • works correctly, • has been assigned to an IP address, • has not been implemented into the network yet by the master.
Blinking red	Connection timeout	A time-out has occurred.
on (red)	Duplicate IP	The network option cannot access the network (IP address conflict).
Blinking green/red	Device self testing	The network option executes a self-test.

The "L/A" LEDs indicate the connection status of ports X396 and X397.

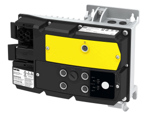
LED "L/A"	Status	Meaning
off	Not connected	Network not available
on	Connected	Network available No data transfer
blinking	Traffic	Data transfer

12.11.5.2 Information on the network

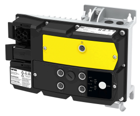
The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x23B2:001	Active Modbus TCP settings: Active IP address • Read only	Display of the active IP address.
0x23B2:002	Active Modbus TCP settings: Active subnet • Read only	Display of the active subnet mask.
0x23B2:003	Active Modbus TCP settings: Active gateway • Read only	Display of the active gateway address. Example The setting 276344004 corresponds to the gateway address 196.172.120.16. • 276344004 = 0x1078ACC4 → 0xC4.0xAC.0x78.0x10 = 196.172.120.16
0x23B2:005	Active Modbus TCP settings: MAC address • Read only	Display of the active MAC address.



Address	Name / setting range / [default setting]	Information
0x23B5:001	Active port settings: Port 1 • Read only 0 Not connected 1 10 Mbps/Half Duplex 2 10 Mbps/Full Duplex 3 100 Mbps/Half Duplex 4 100 Mbps/Full Duplex	Display of the baud rate set for Port 1 in 0x23B4:001.
0x23B5:002	Active port settings: Port 2 • Read only 0 Not connected 1 10 Mbps/Half Duplex 2 10 Mbps/Full Duplex 3 100 Mbps/Half Duplex 4 100 Mbps/Full Duplex	Display of the baud rate set for Port 2 in 0x23B4:001.
0x23B8	Modbus TCP module status • Read only 0 Power off 1 Initialization 2 Warning 3 Fault 4 No configuration 5 Operational	Display of the TCP module state.
0x23B9	Modbus TCP/IP network status • Read only 0 No configuration 1 Initialization 2 Connection time-out 3 Configuration error 4 Not connected 5 Connection established	Display of the active network status.
0x23BA:001	Modbus TCP statistics: Messages received • Read only	Display of the total number of messages received. • This counter counts both valid and invalid messages. • After the maximum value has been reached, the counter starts again "0".
0x23BA:002	Modbus TCP statistics: Valid messages received • Read only	Display of the number of valid messages received. • After the maximum value has been reached, the counter starts again "0".
0x23BA:003	Modbus TCP statistics: Messages with exceptions • Read only	Display of the number of messages with exceptions that have been received. • After the maximum value has been reached, the counter starts again "0".
0x23BA:005	Modbus TCP statistics: Messages sent • Read only	Display of the total number of messages sent. • After the maximum value has been reached, the counter starts again "0".
0x23BE:001	Modbus TCP/IP diagnostics of last Rx/Tx data: Receive offset 0 ... [**0**] ... 240	For diagnostic purposes, the last received message (max. 16 bytes) is displayed in 0x23BE:002. For longer messages, an offset can be specified here, indicating from which byte of the message the display of the 16 bytes is to start.
0x23BE:002	Modbus TCP/IP diagnostics of last Rx/Tx data: Last Rx message • Read only	Display of the message received last.
0x23BE:003	Modbus TCP/IP diagnostics of last Rx/Tx data: Transmit offset 0 ... [**0**] ... 240	For diagnostic purposes, the last sent message (max. 16 bytes) is displayed in 0x23BE:004. For longer messages, an offset can be specified here, indicating from which byte of the message the display of the 16 bytes is to start.
0x23BE:004	Modbus TCP/IP diagnostics of last Rx/Tx data: Last Tx message • Read only	Display of the message sent last.



12.12 PROFINET

PROFINET® (Process Field Network) is a real-time capable network based on Ethernet.

- PROFINET® is a registered trademark and patented technology licensed by the PROFIBUS & PROFINET International (PI) user organization.
- Detailed information on PROFINET can be found on the web page of the user organization: http://www.profibus.com
- PROFINET transmits, between the IO-Devices and a IO-Controller (PLC), parameter data, configuration data, diagnostic data, alarm messages, and process data.
- The data is transmitted as a function of its time-critical behavior via corresponding communication channels.
- The device is implemented as a PROFINET-Device in a PROFINET RT network.
- The PROFINET connections are realized as standard RJ45 sockets.
- Further information about the dimensioning of a PROFINET network can be found in the configuration document.

Prerequisites:

- In 0x231F:005 the network selection is set to "PROFINET".
- The required GSDML device description files for PROFINET are installed in the engineering tool for configuring the network.
  Download of GSDML files

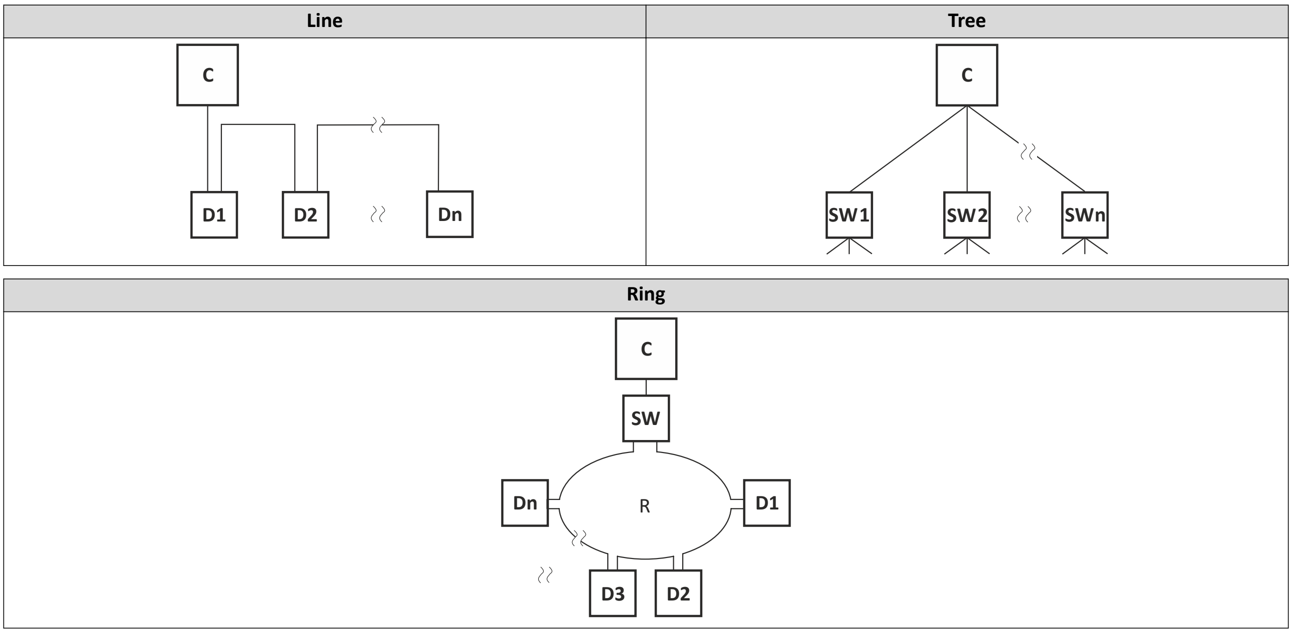
PROFINET connection

The connection is made via the M12 connectors **X396** (IN) and **X397** (OUT).

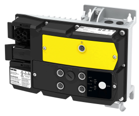
More information about connections can be found on the Internet:

www.profibus.org → PROFINET Cabling and Interconnection Technology

Typical topologies

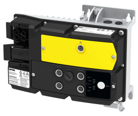


C	IO controller	SW	Switch SCALANCE (MRP capable)
D	IO device	R	Redundant domain



Technical data

Range	Values
Communication profile	PROFINET
Communication medium/cable type	S/FTP (Screened Foiled Twisted Pair, ISO/IEC 11801 or EN 50173), CAT5e Standard Ethernet (acc. to IEEE 802.3), 100Base-TX (Fast Ethernet)
Network topology	Line, star, and tree
Type within the network	PROFINET I/O-Device (slave)
Max. cable length	100 m between two devices
I/O data (PDO data)	• Max. 244 PDOs: freely configurable, regardless of their direction (In, Out, In/Out) • Max. 1024 input bytes and max. 1024 output bytes • Scaling: bytes: 1, 2, 4, 8, 16, 32, 64, 128, 192, 256, 320, 384, 448, 512, 1024 Word: 1, 2, 4, 8, 16, 32, 64, 128, 192, 256, 320, 384, 448, 512 • The combination of I/O data in one slot is possible.
Communication type	PROFINET I/O cyclic
Functions	• Transmission of cyclic process data • Context Management via CL-RPC (Connectionless Remote Procedure Call) The Context Management Protocol is used for establishing and terminating connections, requesting resources, exchanging configuration and diagnostic information, uploading/downloading records. • Setpoint/actual comparison of the PROFINET configuration
Special features in the Lenze automation system	Configuration in the »PLC Designer«: • No submodules • Only one device instance is supported. **No** support of • acyclic write and read requests • DCP (Discovery and basic Configuration Protocol) • RTP (Real-Time Transport Protocol) over UDP (User Datagram Protocol) • Multicast communication • Process/diagnostic alarms • Generic diagnostics, channel diagnostics
Minimum cycle time	2 ms



12.12.1 Commissioning

In the following chapters, the steps required for controlling the inverter with a IO-Controller via PROFINET are described.

Preconditions

- As an IO-Device, the inverter is connected to an IO-Controller and further PROFINET nodes if required.

  See "Typical topologies" under: ▸ PROFINET 373
- The entire wiring has been checked for completeness, short circuit and earth fault.
- All PROFINET devices are supplied with voltage and are switched on.
- The functional test described in the mounting and switch-on instructions has been completed successfully (without any errors or faults).
- The inverter is commissioned with the »EASY Starter«.
  - Download »EASY Starter«
- The IO-Controller is commissioned with a different engineering tool, e. g. Siemens »TIA Portal«.

  For this purpose, install the required GSDML device description file in the engineering tool for the IO-Controller for configuring the inverter.

  We always recommend the use of the current device description.
  - Download of GSDML files
  - Please observe the necessary system requirements and the notes regarding the inverter.

  ▸ Device description file 377

A firmware download from the PLC to the inverter via the network only takes place under the following conditions:

• Required firmware version 05.01.x.x or higher

• Bootloader version 00.00.00.18 or higher

Settings in the »EASY Starter«

1. Activate network control: 0x2631:037 = "TRUE [1]"
2. Set network as standard setpoint source: 0x2860:001 = "Network [5]"

In the default setting, the digital input DI1 is assigned the "Run" function. If the network control is activated, this function serves as "start enable" for start commands via network. Hence, the digital input DI1 must be set to the HIGH level in order that the motor can be started via the network.

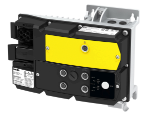
▸ Flexible I/O configuration of the start, stop and rotating direction commands 52

3. Set the IP address and the station name ("PROFINET device name").

   See: ▸ Station name and IP configuration 378
4. Adjust data mapping for process data.

   Observe the information about data mapping and the example below:
5. Save the project in the engineering tool.
6. Save the mapping and all other parameters in the inverter 0x2022:003 with mains failure protection.

   See: ▸ Saving the parameter settings 34



Settings in the »Siemens TIA Portal«

Here, commissioning with the »Siemens TIA Portal« is described.

Please note that in the standard setting of the »Siemens TIA Portal« changes of network parameters carried out by a Lenze engineering tool (e. g. »EASY Starter«) may be overwritten.

1. Go to the device configuration and open the "net view" to drag the inverter from the catalog to the net view of the PROFINET.
2. Assign the inverter to the associated IO-Controller.
3. Mark the inverter and change to the "device view".
4. Set the IP address and the station name ("PROFINET device name") in "Properties".

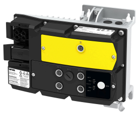
In order that the inverter can be identified via Ethernet when the IO controller is switched off, it is necessary that the IP address is saved in the inverter with mains failure protection via the separate entry with the »EASY Starter«.

Use the 0x2022:003 parameter to save the settings. More information: Saving the parameter settings 34

5. Below the module name and the name of the device description file, the device view shows the pre-assignment of three output and input process data words:

Module
LENZE-I550-DRIVE_2
IOFW51ARXX
L-Controlword 0x4008:01 _1
Netwfreq. 0.01Hz 0x400B:05_1
16Bit selectable OUT-Data_1
L-Statusword 0x400A:01_1
Act.freq. 0.01Hz 0x400C:06_1
Act.mot.current 0x2D88:00_1

   - Additional process data words can be added or pre-allocated process data words can be changed in the device view.
   - The length of the process data can be selected based on the GSDML device description file.
   - All addresses of the input and output data words must follow each other without interruption.
   - Observe the information about data mapping and the example below:
6. Save the project in the engineering tool.
7. Load the configuration into the IO-Controller.
8. Place the IO-Controller in "RUN", e. g. by setting bit 4 in the NetWordIN1 control word (0x400E:005).
   - The start-up causes the current configuration to be transferred to the inverter.
   - If required, save mapping and all other parameters in the inverter with 0x2022:003 with mains failure protection, see Saving the parameter settings 34



Restart or stop communication

The 0x2380 parameter can be used to restart or stop communication. Optionally it is also possible to reset all communication parameters to the default status.

A restart of communication is required after changes of the interface configuration (e. g. station address and baud rate) in order that the changed settings become effective.

For restarting communication, there are two options:

1. Switch inverter off and on again.
2. 0x2380 Set = 1 (Restart with current values).

12.12.1.1 Restarting or stopping the communication

Restart or stop communication

The 0x2380 parameter can be used to restart or stop communication. Optionally, it is also possible to reset all communication parameters to the last saved state.

A restart of communication is required after changes of the interface configuration (e. g. station address and baud rate) in order that the changed settings become effective.

For restarting communication, there are two options:

1. Switch inverter off and on again.
2. Set 0x2380 = 1 (Restart with current values).

Parameter

Address	Name / setting range / [default setting]		Information
0x2380	PROFINET communication		Restart / stop communication • When the device command has been executed successfully, the value 0 is shown.
	0	**No action/no error**	Only status feedback
	1	Restart with current values	Restart communication with the current values.
	2	Restart with stored values	Restart communication with the values of the PROFINET parameters that have been saved last (0x2381:001 ... 0x2381:009).
	10	In progress	Only status feedback
	11	Action cancelled	
	12	Fault	

12.12.1.2 Device description file

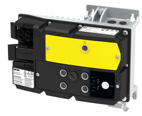
The device description file must be installed in the engineering tool for configuring the network (e. g. Siemens »TIA Portal«).

- Download of GSDML files

The name of the device description file is as follows:

"GSDML-V<x>.<zz>-Lenze-I<NNN>PN<Version>-<yyyy><mm><dd>.xml".

Wildcard	Info
x	Major version of the used GSDML scheme
zz	One-digit or two-digit minor version of the used GSDML scheme
NNN	Specifying the inverter name, e. g. i<550>, i<950>, ...
Version	First software version that can be used with this GSDML.
yyyy	Year of publication
mm	Month of publication
dd	Day of publication



12.12.2 Basic setting and options

12.12.2.1 Station name and IP configuration

The station name and the IP configuration can be assigned by the IO-Controller. These settings enable the IO-Controllerto identify the devices in the network and manage the data exchange.

The station name and the IP configuration can also be assigned by the »Engineering Tool«.

- The station name of the IO device must be entered with permissible characters according to the PROFINET specification. ▸ 0x2381:004
- Display of the currently used station name: ▸ 0x2382:004
- The IP configuration comprises the assignments of:
  - IP address ▸ 0x2381:001
  - Subnet mask ▸ 0x2381:002
  - Gateway address ▸ 0x2381:003
- Display of the actual IP configuration: ▸ 0x2382:001 ... 0x2382:003

Save the station name and the IP configuration in the IO Device with line voltage failure protection so the IO Device can be identified via PROFINET if the IO controller is switched off. 0x2022:003

▸ Saving the parameter settings 📖 34

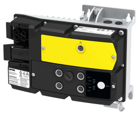
An invalid station name or the assignment of invalid combinations of the IP address, subnet mask, and gateway address can have the consequence that no connection to PROFINET can be established.

In case of impermissible settings, the red LED "bus ERR" is blinking and the error message "PROFINET: Stack initialization error [0x8192]" is output.

▸ LED status display 📖 384

Parameter

Address	Name / setting range / [default setting]	Information
0x2381:001	PROFINET settings: IP address 0.0.0.0 ... [**0.0.0.0**] ... 255.255.255.255	Set IP address • A changed value will only be effective after the PROFINET communication is restarted (0x2380 = 1).
0x2381:002	PROFINET settings: Subnet 0.0.0.0 ... [**0.0.0.0**] ... 255.255.255.255	Set subnet mask • A changed value will only be effective after the PROFINET communication is restarted (0x2380 = 1).
0x2381:003	PROFINET settings: Gateway 0.0.0.0 ... [**0.0.0.0**] ... 255.255.255.255	Set gateway address • A changed value will only be effective after the PROFINET communication is restarted (0x2380 = 1). • The gateway address is valid if the network address of the IP address is identical to the gateway address. In this case, no gateway functionality is used. • DHCP is not supported.
0x2381:004	PROFINET settings: Station name ["**0**"]	Set station name • A changed value will only be effective after the PROFINET communication is restarted (0x2380 = 1).
0x2381:005	PROFINET settings: I&M1 System designation ["**0**"]	Input/output of the I&M1 system designation • The default setting is an empty string.
0x2381:006	PROFINET settings: I&M1 Installation site ["**0**"]	Input/output of the I&M1 location identification code • The default setting is an empty string.
0x2381:007	PROFINET settings: I&M2 Installation date ["**0**"]	Input/output of the I&M2 date of installation • The default setting is an empty string.
0x2381:008	PROFINET settings: I&M3 additional information ["**0**"]	Input/output of the I&M3 additional information • The default setting is an empty string.
0x2381:009	PROFINET settings: I&M4 signature code ["**0**"]	Input/output of the I&M4 signature • The default setting is an empty string.



12.12.2.2 Suppress diagnostic messages to the IO controller

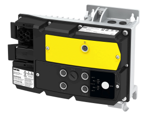
Inverter errors and warnings are sent to the IO controller as alarm messages. This function is used to suppress, for example, the fact that the "undervoltage DC link" warning triggers an alarm and the associated control switches to the stop mode if there is no associated alarm block or has been programmed manually. It should be noted here, that an alarm block not programmed in the control can pose risks to the machine. A reduction of possible alarm messages initially helps when the machine is commissioned. Later on, however, more effort should be made to program the alarm blocks.

Please note that an unprogrammed alarm block in the IO controller can pose risks to the machine. A reduction of possible alarm messages initially helps when the machine is commissioned. Later on, however, more effort should be made to program the alarm blocks.

▸ 0x285A:001 serves to set which error response in the device suppresses the alarm message to the IO-Controller.

Parameter

Address	Name / setting range / [default setting]		Information
0x285A:001	Diagnostic configuration: Alarm suppression 0 ... [**0**] ... 65535		Bit coded selection of error responses which suppress the alarm message to the IO controller. • Bit x = 1 = suppress alarm message. • In the default setting "0", an alarm message is displayed for all error responses.
	Bit 0	Information	
	Bit 1	Warning	
	Bit 3	Trouble	
	Bit 7	Fault	



12.12.3 Process data transfer

The process data is used to control the inverter.

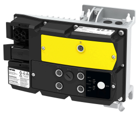
- The process data is transmitted cyclically between the IO-Controller and the IO-Devices participating in PROFINET.
- The process data can be directly accessed by the IO controller. The data in the PLC, for instance, are directly stored in the I/O area.
- The available 27 network registers ("slots") serve to maximally exchange 16 process data words (data types 8-bit or 16-bit) or 8 process data double words (data type 32-bit) for each direction.
- Output data direction: From IO-Controller to IO-Device.
- Input data direction: From IO-Device to IO-Controller.

Data mapping

Data mapping is used to define which process data is exchanged cyclically between IO-Controller and IO-Device.

- If the inverter is known as IO-Device in the PROFINET network and the IO-Controller connects to the inverter for the first time, the mapping objects are automatically transmitted to the inverter.
- Internal mapping of the process output data: ...
- Internal mapping of the process input data: ...

All subsequent changes in the objects 0x24E0 and 0x24E1 can cause PROFINET alarms according to the deviation from the automatically set configurations.



RPDO mapping

The assignment of different bits with the same function is not permissible.

For the process data from the IO-Controller to the inverter, this data mapping is preset in the device description file:

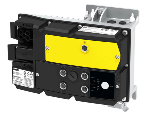
1. NetWordIN1 data word 0x4008:001
2. Network setpoint frequency (0.01)0x400B:005

Function assignment of the NetWordIN1 data word

Bit	Default setting	For details and configuration, see
0	Not active (reserve)	0x400E:001
1	Not active (reserve)	0x400E:002
2	Activate quick stop	0x400E:003
3	Not active (reserve)	0x400E:004
4	Run forward (CW)	0x400E:005
5	Activate preset (bit 0)	0x400E:006
6	Activate preset (bit 1)	0x400E:007
7	Reset error	0x400E:008
8	Not active (reserve)	0x400E:009
9	Activate DC braking	0x400E:010
10	Not active (reserve)	0x400E:011
11	Not active (reserve)	0x400E:012
12	Reverse rotational direction	0x400E:013
13	Not active (reserve)	0x400E:014
14	Not active (reserve)	0x400E:015
15	Not active (reserve)	0x400E:016

Specifying the frequency setpoint

- The specification is made unsigned (independent of the direction of rotation) as integer in the resolution [0.01 Hz].
- The direction of rotation is defined in the default setting via bit 12 of the NetWordIN1 data word.
- Example: 4560 = 45.60 Hz



TPDO mapping

> The assignment of different bits with the same function is not permissible.

For the process data from the inverter to the IO-Controller, the following data mapping is preset in the device description file:

1. NetWordOUT1 data word 0x400A:001
2. Frequency (0.01)0x400C:006
3. Motor current0x2D88

Status assignment of the NetWordOUT1 data word

Bit	Default setting	For details and configuration, see
0	Ready for operation	0x2634:010
1	Not connected	0x2634:011
2	Operation enabled	0x2634:012
3	Fault active	0x2634:013
4	Not connected	0x2634:014
5	Quick stop active	0x2634:015
6	Running	0x2634:016
7	Device warning active	0x2634:017
8	Not connected	0x2634:018
9	Not connected	0x2634:019
10	Setpoint speed reached	0x2634:020
11	Current limit reached	0x2634:021
12	Actual speed = 0	0x2634:022
13	Rotational direction reversed	0x2634:023
14	Release holding brake	0x2634:024
15	Inverter disabled (safety)	0x2634:025

Output of the actual frequency value

- The output is made unsigned (independent of the direction of rotation) as integer in the resolution [0.01 Hz].
- An active reversal is displayed via bit 13 of the NetWordOUT1 data word.
- Example: 4560 = 45.60 Hz

12.12.4 Parameter data transfer

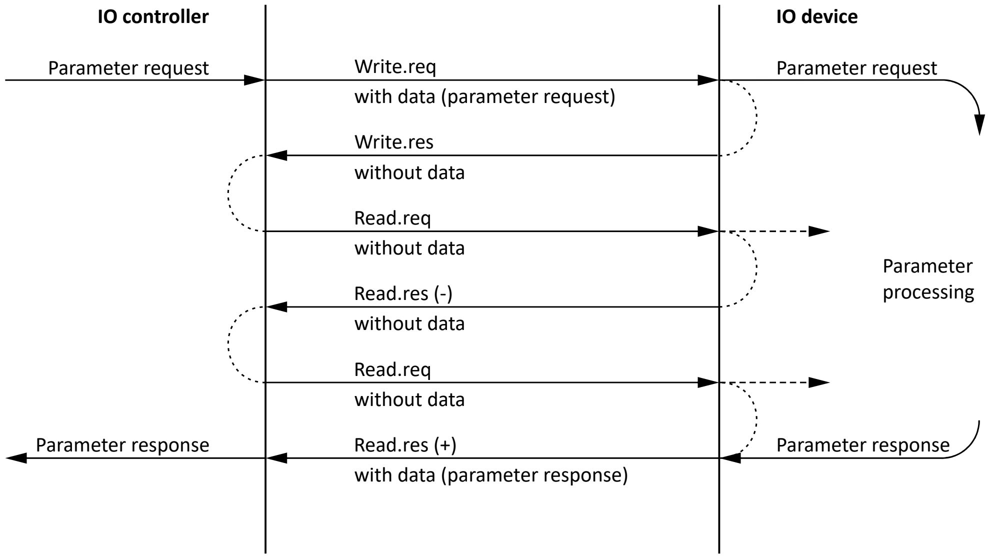
Data communication with PROFINET is characterised by the simultaneous operation of cyclic and acyclic services in the network. As an optional extension, the parameter data transfer belongs to the acyclic services, which provides access to all device parameters.

Details

- The access to the device data depends on the PROFIdrive profile.
- Only one parameter request is processed at a time (no pipelining).
- No spontaneous messages are transferred.
- There are only acyclic parameter requests.

Basically, a IO-Controller can always be used to request parameters from IO-Device if the IO-Device is in the DATA_EXCHANGE state.

Transmission directions for acyclic data transfer

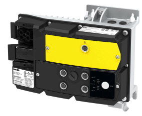


1. A "Write.req" is used to transmit the data set (DB47) as parameter request to the IO-Device.
2. "Write.res" is used to confirm the input of the message for IO-Controller.
3. With Read.req, the IO-Controller requests the response of the IO-Device
4. The IO-Device responds with a "Read.res (-)" if processing has not been completed yet.
5. After parameter processing, the parameter request is completed by transmitting the parameter response to the IO-Controller by "Read.res (+)".

Frame structure

Destr	ScrAddr	VLAN	Type 0x0800	RPC	NDR	Read/Write Block	Data	FCS
6 bytes	6 bytes	4 bytes	4 bytes	80 bytes	64 bytes	64 bytes	0 .... 240 bytes	4 bytes

In the "Read / Write Block field", the initiator specifies the access to the "DB47" data set. The data that is written on this index or read by it, contain a header and the parameter request or the parameter response. The read data or the data to be written are contained in the "Data" field.



Assignment of the user data depending on the data type

Depending on the data type used, the user data is assigned as follows:

Data type	Length	User data assignment				
		Byte 1	**Byte 2**	**Byte 3**	**Byte 4**	**Byte ...**
String	x bytes	*Data* (x bytes)				
U8	1 byte	*Data*	0x00			
U16	2 bytes	HIGH byte	LOW byte			
		Data	*Data*			
U32	4 bytes	HIGH word		LOW word		
		HIGH byte	LOW byte	HIGH byte	LOW byte	
		Data	*Data*	*Data*	*Data*	

12.12.5 Diagnostics

12.12.5.1 LED status display

The LEDs "BUS RDY" and "BUS ERR" indicate the connection status to the IO-Controller.

"BUS RDY" LED (green)	State	Meaning
Off	Not connected	No connection to the IO-Controller
Blinking	Connected	IO-Controller in STOP
On	Data exchange	IO-Controller in RUN (DATA_EXCHANGE)

"BUS ERR" LED (red)	State	Meaning
Off	No fault	No fault
Blinking fast	IO-Device identifies (localises)	The PROFINET function "node flashing test" is triggered by IO-Controller. The flickering LED serves to identify (locate) an accessible IO-Device.
Blinking	Impermissible settings	Impermissible settings: Stack, station name or IP parameters are invalid.
On (red)	Fault	Communication error (e. g. Ethernet cable removed)

The "L/A" LEDs indicate the connection status of ports X396 and X397.

LED "L/A"	Status	Meaning
off	Not connected	Network not available
on	Connected	Network available No data transfer
blinking	Traffic	Data transfer

12.12.5.2 Information on the network

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x2382:001	Active PROFINET settings: IP address • Read only	Display of the active IP address.
0x2382:002	Active PROFINET settings: Subnet • Read only	Display of the active subnet mask.
0x2382:003	Active PROFINET settings: Gateway • Read only	Display of the gateway address.
0x2382:004	Active PROFINET settings: Station name • Read only	Display of the active station name.
0x2382:005	Active PROFINET settings: MAC Address • Read only	Display of the active MAC address.

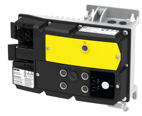
Address	Name / setting range / [default setting]		Information
0x2388	PROFINET status • Read only		Bit coded display of the current Bus status.
	Bit 0	Initialized	The network component is initialised.
	Bit 1	Online	After initialisation, the network component waits for a communication partner and the system power-up.
	Bit 2	Connected	The network component has established a cyclic I/O communication relationship to a communication partner.
	Bit 8	PROFINET stack ok	
0x2389:001	PROFINET error: Error 1 • Read only		The parameter currently contains the error detected on the network. • The error values may occur in combination with the error values from parameter 0x2389:002.
	0	No error	
0x2389:002	PROFINET error: Error 2 • Read only		The parameter currently contains the error detected on the network. • The error values may occur in combination with the error values from parameter 0x2389:001.
	Bit 7	IP address error	The IP address is invalid. Valid IP addresses are defined according to RFC 3330.
	Bit 8	Station name problem	The station name must be assigned according to the PROFINET specification.
	Bit 9	DataExch left	PROFINET communication is continuously interrupted in the "Data_Exchange" state, e. g. by cable break. • PROFINET communication changes to the "No_Data_Exchange" state. • When the watchdog monitoring time specified by the IO Controller has elapsed, the response set in is triggered in the device.
	Bit 14	Initialization problem	The stack cannot be initiated with the user specifications. A reason might be, e. g., a station name that does not correspond to the PROFINET specification.

12.12.6 PROFIenergy

12.12.6.1 Supported measured values

Parameter

Address	Name / setting range / [default setting]	Information
0x2DA2:001	Output power: Effective power • Read only: x.xxx kW	Display of the active output power for an energy analysis in the respective application.
0x2DA2:002	Output power: Apparent power • Read only: x.xxx kVA	Display of the apparent output power for an energy analysis in the respective application.
0x2DA3:001	Output energy: Motor • Read only: x.xx kWh	Display of the output power in motor mode for an energy analysis in the respective application.
0x2DA3:002	Output energy: Generator • Read only: x.xx kWh	Display of the output power in generator mode for an energy analysis in the respective application.



12.13 Monitoring

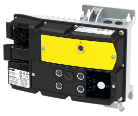
Parameter

Address	Name / setting range / [default setting]		Information
0x2859:001	Network monitoring: Watchdog elapsed		Selection of the response to a permanent interruption of the communication to the IO controller. Associated error code: • 33168 | 0x8190 - Network - Watchdog time-out
	0	No response	▶ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	
0x2859:003	Network monitoring: Invalid configuration		Selection of the response triggered by the reception of invalid configuration data. Associated error code: • 33414 | 0x8286 - Network - PDO mapping error
	0	No response	▶ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	
0x2859:004	Network monitoring: Initialisation error		Selection of the response triggered by the occurrence of an error during the initialization of the network component. Associated error code: • 33170 | 0x8192 - Network - Initialization error
	0	No response	▶ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	
0x2859:005	Network monitoring: Invalid process data		Selection of the response triggered by the reception of invalid process data. Process data marked as invalid (IOPS is "BAD") are received by the IO Controller. Typically in case of • a PLC in STOP state, • alarms, • acyclic demand data. Associated error code: • 33171 | 0x8193 - Network - Invalid cyclic process data
	0	No response	▶ Error types 📖 444
	11	Information	
	12	Warning	
	16	**Trouble**	
	23	Fault	

12.14 Internal mapping of the process data

The data mapping defines which process data are cyclically exchanged between network master and inverter.

The assignment of the network registers and the number of data words that can be transmitted cyclically varies according to the network/communication protocol. You can find detailed information in the documentation for the respective communication protocol.



13 Device functions

13.1 Optical device identification

For applications including several interconnected inverters it may be difficult to locate a device that has been connected online. The "Optical device identification" function serves to locate the inverter by means of blinking LEDs.

Details

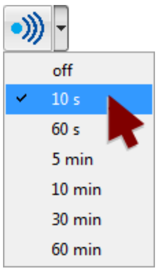
In order to start the visual tracking,

- click the button in the toolbar of the »EASY Starter« or
- set 0x2021:001 = "Start [1]".

After the start, both LEDs "RDY" and "ERR" on the front of the inverter synchronously blink very fast.

"RDY" LED (blue)	"ERR" LED (red)	Status/meaning
Both LEDs are blinking in a very rapidly synchronous mode		"Visual tracking" function is active.

The blinking duration can be set in 0x2021:002 or selected in the »EASY Starter« in the dropdown list field:



Parameter

Address	Name / setting range / [default setting]		Information
0x2021:001	Optical tracking: Start detection		1 = start optical device identification. • After the start, the two LEDs "RDY" and "ERR" on the front of the inverter are blinking with a blinking frequency of 20 Hz for the blinking duration set in 0x2021:002. The setting is then automatically reset to "0" again. • If the function is reactivated within the blinking time set, the time is extended correspondingly. • A manual reset to "0" makes it possible to stop the function prematurely.
	0	**Stop**	
	1	Start	
0x2021:002	Optical tracking: Blinking duration 0 ... **[5]** ... 3600 s		Setting of the blinking duration for the visual tracking.

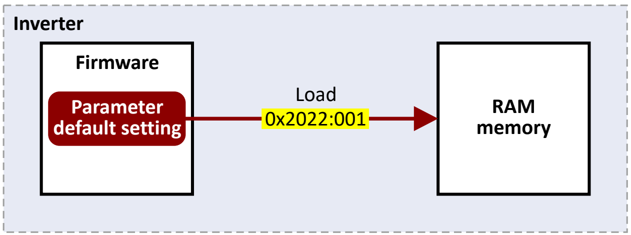
13.2 Reset parameters to default

With the "Load default settings" device command, all parameters can be reset to the default setting.

By executing this device command, all parameter settings made by the user are lost!

Details

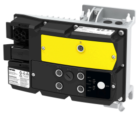
- All current parameters in the RAM memory of the device are overwritten by the default parameters stored in the firmware. The persistent parameters in the memory module remain unaffected by this measure.



- Afterwards, the device can be parameterized again on the basis of this initial state.
- Typical application: Incorrect or unknown parameter settings.
- The device command only has an effect on the RAM. For a permanent acceptance of the changes made, the data must subsequently be saved in memory. ▶ Saving/loading the parameter settings 📖 390

Parameter

Address	Name / setting range / [default setting]	Information
0x2022:001	Device commands: Load default settings • Setting can only be changed if the inverter is disabled.	1 = reset all parameters in the RAM memory of the inverter to the default setting that is stored in the inverter firmware. • All parameter changes made by the user are lost during this process! • It may take some seconds to execute the task. When the task has been executed successfully, the value 0 is shown. • Loading parameters has a direct effect on the cyclic communication: The data exchange for control is interrupted and a communication error is generated.
	0 **Off / ready**	Only status feedback
	1 On / start	Execute device command
	2 In progress	Only status feedback
	3 Action cancelled	



13.3 Saving/loading the parameter settings

If parameter settings of the inverter are changed, these changes at first are only made in the RAM memory of the inverter. In order to save the parameter settings with mains failure protection, the inverter is provided with a firmly integrated memory module and corresponding device commands.

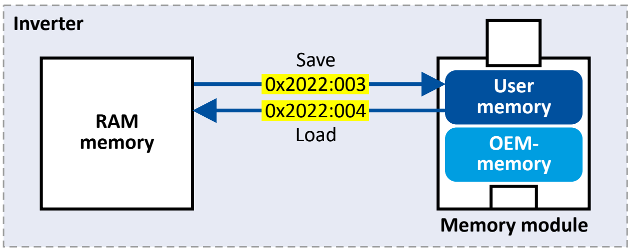
Details

The memory module has two memories, the user memory and the OEM memory.

User memory

The user memory is used as power-failure-proof storage of parameter settings made by the user during commissioning/operation.

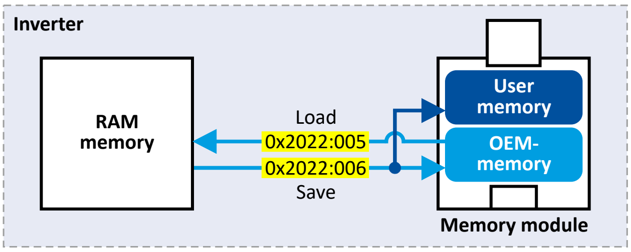
- Parameter settings carried out with »EASY Starter« or via network must be explicitly saved in the user memory by means of the "Save user data" device command, so that the changes carried out are not lost when the mains of the inverter are switched.
- Saving can also be made in the »EASY Starter« via the button or the **<F6>** function key.
- The device command "Load user data" serves to reload the data from the user memory into the RAM.

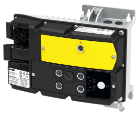


OEM memory

The OEM memory is provided for the storage of customized parameter settings by the OEM/machine builder.

- With the "Load OEM data" device command, the parameter settings preconfigured by the OEM/machine builder can be reloaded to the RAM memory of the inverter at any time if required.
- For saving parameter settings in the OEM memory, the "Save OEM data" device command must be executed explicitly. The parameter settings are simultaneously saved in the user memory.





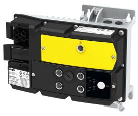
Behavior after the inverter is switched on for the first time

After switch-on, the inverter first tries to load the parameter settings stored in the user memory. If the user memory is empty or damaged, an error message is output and the user must intervene:

- Case 1 = user memory empty: → default setting is loaded automatically from the firmware → data are saved automatically in the user memory of the memory module.
- Case 2 = user memory damaged: → Error message → default setting is loaded automatically → data are saved automatically in the user memory of the memory module.
- Case 3 = OEM memory empty/damaged: → error message → data are loaded automatically from the user memory of the memory module.

Parameter

Address	Name / setting range / [default setting]		Information
0x2022:003	Device commands: Save user data		1 = save current parameter settings in the user memory of the memory module with mains failure protection. • This process may take some seconds. When the device command has been executed successfully, the value 0 is shown. • Do not switch off the supply voltage during the saving process and do not unplug the memory module from the device! • When the device is switched on, all parameters are automatically loaded from the user memory of the memory module to the RAM memory of the device.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:004	Device commands: Load user data • Setting can only be changed if the inverter is disabled.		1 = load data from the user memory of the memory module to the RAM memory of the inverter. • When the device command has been executed successfully, the value 0 is shown. • Loading parameters has a direct effect on the cyclic communication: The data exchange for control is interrupted and a communication error is generated.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:005	Device commands: Load OEM data • Setting can only be changed if the inverter is disabled.		1 = load data from the OEM memory of the memory module to the RAM memory of the inverter. • When the device command has been executed successfully, the value 0 is shown. • Loading parameters has a direct effect on the cyclic communication: The data exchange for control is interrupted and a communication error is generated.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:006	Device commands: Save OEM data		1 = save current parameter settings in the OEM memory of the memory module with mains failure protection. • At the same time, the parameter settings are saved in the main memory of the memory module. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	



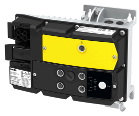
Related topics

▸ Behaviour of the inverter in case of incompatible data in the memory module 🕮 403

13.4 Enabling the device

Parameter

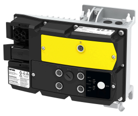
Address	Name / setting range / [default setting]		Information
0x2822:001	Axis commands: Enable inverter		Parameters for interaction with engineering tools.
	0	**Inverter inhibited**	
	1	Inverter enabled	



13.5 Restart device

Parameter

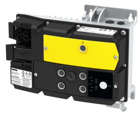
Address	Name / setting range / [default setting]		Information
0x2022:035	Device commands: Restart Device • Setting can only be changed if the inverter is disabled.		Parameter for interaction with engineering tools.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	



13.6 Activate/deactivate PDO communication

Parameter

Address	Name / setting range / [default setting]		Information
0x2022:032	Device commands: Disable PDO Communication		Parameter for interaction with engineering tools.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:033	Device commands: Activate PDO Communication		Parameter for interaction with engineering tools.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	



13.7 Switching frequency changeover

The output voltage of the inverter is a DC voltage with sine-coded pulse width modulation (PWM). This corresponds by approximation to an AC voltage with variable frequency. The frequency of the PWM pulses is adjustable and is called "switching frequency".

Not all products support all options.

Details

The switching frequency has an impact on the smooth running performance and the noise generation in the motor connected as well as on the power loss in the inverter. The lower the switching frequency, the better the concentricity factor, the smaller the power loss and the higher the audible noise .

Parameter

<table>
<tr><th>Address</th><th colspan="2">Name / setting range / [default setting]</th><th>Information</th></tr>
<tr><td rowspan="9">0x2939</td><td colspan="2">Switching frequency</td><td rowspan="9">Selection of the inverter switching frequency.
Abbreviations used:
• "Variable": Adaptation of the switching frequency as afunction of the current. The carrier frequency is reduced depending on the heat sink temperature and the ixt load.
• "Fixed": The carrier frequency is fixed, no frequency reduction.
• "Drive-optimised": reduces the capacitive currents from the motor to the earth.
• "Min. Pv": reduces the capacitive currents from the motor to the earth and optimizes power dissipation.</td></tr>
<tr><td>11</td><td>4 kHz variable / min. Pv</td></tr>
<tr><td>12</td><td>8 kHz variable / min. Pv</td></tr>
<tr><td>13</td><td>16 kHz variable / min. Pv</td></tr>
<tr><td>14</td><td>12kHz variable / min. Pv</td></tr>
<tr><td>16</td><td>4 kHz fixed / min. Pv</td></tr>
<tr><td>17</td><td>8 kHz fixed / min. Pv</td></tr>
<tr><td>18</td><td>16 kHz fixed / min. Pv</td></tr>
<tr><td>19</td><td>12 kHz fixed / min. Pv</td></tr>
<tr><td rowspan="11">0x293A</td><td colspan="2">Actual switching frequency
• Read only</td><td rowspan="11">Display of the currently active switching frequency of the inverter.
Example:
• "16 kHz variable / drive-optimised / 4 kHz min. [22]" is selected as switching frequency in 0x2939.
• An increase of the ambient temperature and/or the load have caused a decrease of the switching frequency to 8 kHz. In this case, this parameter indicates the selection "8 kHz power loss-optimized [7]".</td></tr>
<tr><td>1</td><td>2 kHz drive-optimized</td></tr>
<tr><td>2</td><td>4 kHz drive-optimized</td></tr>
<tr><td>3</td><td>8 kHz drive-optimized</td></tr>
<tr><td>4</td><td>16 kHz drive-optimized</td></tr>
<tr><td>5</td><td>2 kHz power loss-optimized</td></tr>
<tr><td>6</td><td>4 kHz power loss-optimized</td></tr>
<tr><td>7</td><td>8 kHz power loss-optimized</td></tr>
<tr><td>8</td><td>16 kHz power loss-optimized</td></tr>
<tr><td>9</td><td>12 kHz drive-optimised</td></tr>
<tr><td>10</td><td>12 kHz power loss-optimised</td></tr>
</table>

13.8 Device overload monitoring (ixt)

The inverter calculates the i*t utilisation in order to protect itself against thermal overload. In simple terms: a higher current or an overcurrent that continues for a longer time causes a higher i*t utilisation.

⚠ DANGER!

Uncontrolled motor movements by pulse inhibit.

When the device overload monitoring function is activated, pulse inhibit is set and the motor has no torque. A load that is connected to motors without a holding brake may therefore cause uncontrolled movements! Without a load, the motor will coast.

Possible consequences: Death or severe injuries

▶ Only operate the inverter under permissible load conditions.

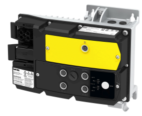
Details

The device overload monitoring function primarily offers protection to the power section. Indirectly, also other components such as filter chokes, circuit-board conductors, and terminals are protected against overheating. Short-time overload currents followed by recovery periods (times of smaller current utilisation) are permissible. The monitoring function during operation checks whether these conditions are met, taking into consideration that higher switching frequencies and lower stator frequencies as well as higher DC voltages cause a greater device utilisation.

- If the device utilisation exceeds the warning threshold set in 0x2D40:002 (default setting: 95 %), the inverter outputs a warning.
- If the device utilisation exceeds the permanent error threshold 100 %, the inverter is disabled immediately and any further operation is stopped.
- Device overload monitoring depends on the inverter load characteristic (heavy duty/light duty).
- The device overload can be obtained from the configuration document.

Parameter

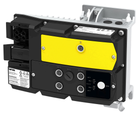
Address	Name / setting range / [default setting]		Information
0x2D40:002	Device utilisation ixt: Power unit warning threshold 0 ... **[95]** ... 101 %		If the device utilisation exceeds the threshold set, the inverter outputs a warning. • With the setting 0 % or ≥ 100 %, the warning is deactivated.
0x2D40:004	Device utilisation ixt: Device actual utilisation • Read only: x %		Display of the current device utilisation.
0x2D40:005	Device utilisation ixt: Error response		Selection of the response to be executed when the device overload monitoring function is triggered. Associated error code: • 9090 | 0x2382 - Fault - Device utilization (ixt) too high
	16	Trouble	▸ Error types 📖 444
	23	**Fault**	



13.9 Heatsink temperature monitoring

Parameter

Address	Name / setting range / [default setting]	Information
0x2D84:001	Heatsink temperature: Heatsink temperature • Read only: x.x °C	Display of the current heatsink temperature.
0x2D84:002	Heatsink temperature: Warning threshold 50.0 ... [**80.0**] ... 100.0 °C	Warning threshold for temperature monitoring. • If the heatsink temperature exceeds the threshold set here, the inverter outputs a warning. • The warning is reset with a hysteresis of approx. 5 °C. • If the heatsink temperature increases further and exceeds the non-adjustable error threshold (100 °C), the inverter changes to the "Fault" device status. The inverter is disabled and thus any further operation is stopped.
0x2D84:003	Heatsink temperature: Fan on threshold 0.0 ... [**0.0**] ... 100.0 °C	Switch-on threshold for device fans.
0x2D84:004	Heatsink temperature: Fan off threshold 0.0 ... [**0.0**] ... 100.0 °C	Switch-off threshold for device fans. • If the heatsink temperature falls below the threshold set here, the device fan is switched off. This only happens if the switch-off threshold is parameterized lower than the switch-on threshold. • Larger designs of the inverter also have an internal fan. This is controlled in parallel with the heatsink fan and has no switch-on or switch-off thresholds of its own.



13.10 Automatic restart after a fault

Configuration of the restart behaviour after a fault.

The settings have no impact on errors and warnings of the inverter.

Parameter

Address	Name / setting range / [default setting]	Information
0x2839:002	Fault configuration: Restart delay 0.0 ... [**3.0**] ... 1000.0 s	If a fault occurs, a restart is possible at the earliest after the time set here has elapsed.
0x2839:003	Fault configuration: Number of restart attempts 0 ... [**5**] ... 255	Number of restart attempts after a fault. • 255 = unlimited number of restart attempts.
0x2839:004	Fault configuration: Trouble counter reset time 0.1 ... [**40.0**] ... 3600.0 s	Time of trouble-free operation after which the fault counter is decreased by 1.
0x2839:005	Fault configuration: Trouble counter • Read only	Display of the current fault counter content. • The counter content is increased by 1 after each restart attempt.

Related topics

▶ Error handling 📖 443

▶ Timeout for error response 📖 445

13.11 User-defined error triggering

The "Activate fault 1" and "Activate fault 2" functions serve to set the inverter from the process to the error status.

Details

If, for instance, sensors or switches are provided for process monitoring, which are designed to stop the process (and thus the drive) under certain conditions, these sensors/switches can be connected to free digital inputs of the inverter. The digital inputs used for the sensors/switches then have to be assigned to the functions "Activate fault 1" and "Activate fault 2" as triggers.

Parameter

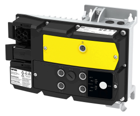
Address	Name / setting range / [default setting]		Information
0x2631:043	Function list: Activate fault 1 • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Activate fault 1" function. Trigger = TRUE: Trigger user-defined error 1. Trigger = FALSE: no action. Associated event ID: • 25217 | 0x6281 - User-defined fault 1
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:044	Function list: Activate fault 2 • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Activate fault 2" function. Trigger = TRUE: Trigger user-defined error 2. Trigger = FALSE: no action. Associated event ID: • 25218 | 0x6282 - User-defined fault 2
	0	**Not connected**	No trigger assigned (trigger is constantly FALSE).

Example

An example of the operating mode can be found in the chapter "Error reset". 📖 445

Related topics

▸ Error handling 📖 443



13.12 Update device firmware

The device firmware is continuously improved by the manufacturer. New firmware versions contain error corrections, function extensions and simplify the handling.

A new firmware is always compatible with the older version:

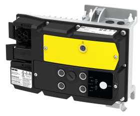
- A device with updated firmware and unchanged parameter settings shows the same behaviour as before.
- Parameter settings must only be adapted if new functions are used.

Details

The inverter i550 supports the manual firmware download with the »EASY Starter (Firmware loader)« as well as the automatic firmware download via EtherCAT. The main reason for an automatic firmware download is the simultaneous update of firmware and parameter settings for an already finished machine.

Typical applications for an automatic firmware download:

- Series production: All machines automatically receive the firmware released for the machine including parameter settings.
- Device replacement: If a device replacement is required, the device automatically gets the suitable firmware including parameter settings without the need for an intervention or special knowledge of the machine operator.
- Device update: Due to function extensions or error corrections, an update of the firmware is almost automatically possible for the machine manufacturer or end user.



13.12.1 Firmware download with »EASY Starter (firmware loader)«

The »EASY Starter (firmware loader)« is a PC software which serves to update the firmware of the device.

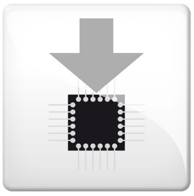
Preconditions

- For the firmware download, we recommend a direct USB connection to the device. The voltage supply for the control electronics also runs via the USB connection.
- The control electronics of the inverter must be supplied with voltage. Either via the USB connection or via the external 24-V voltage supply.
- Voltage supply and communication must not be interrupted during the firmware download.

Details

Together with the »EASY Starter« engineering tool, the following tools are installed as well:

Tool	Brief description
»EASY Navigator«	Helps you to find the right tool for your application.
»EASY Package Manager«	Enables the automatic download and the installation of files for the engineering tools. • For this purpose, the »EASY Package Manager« is provided with current files by the manufacturer and enables the user to install them. • The files also include new firmware versions for inverters.
»EASY Starter (firmware loader)«	Enables the update of the firmware for inverters. • The update can be made by the mechanical engineer or the end user depending on the access protection set for the device.



Carry out the firmware download with the »EASY Starter (firmware loader)«:

1. Start »EASY Navigator« (All programs → Lenze → EASY Navigator).
2. In the »EASY Navigator«, change to the "Ensuring productivity" engineering phase.
3. Click the »EASY Starter (firmware loader)« icon (see on the left).
4. Follow the instructions of the »EASY Starter (firmware loader)«.

Notes:

- The firmware download will not take more than 20 seconds. The progress is shown in the »EASY Starter (firmware loader)«.
- After the firmware download, the connection to the device gets lost for some second and is then restored again automatically.
- Device settings are not changed by the firmware download.
- The brand protection does not get lost by the firmware download.
- The firmware can neither be exported from the device nor be deleted from the device.

If the connection is aborted during the firmware download, this may have the following consequences:

- The device starts with the old firmware. The firmware download can be restarted.
- The firmware in the device is damaged. Consultation with the manufacturer is required.

13.13 Behaviour of the inverter in case of incompatible data in the memory module

Below you will find a description of the inverter behaviour when the data on the memory module does not match the inverter hardware or firmware.

The following points are described in detail here:

- Automatic loading of the parameter settings when the inverter is switched on
- Manual loading of the user data via device command
- Manual loading of the OEM data via device command
- Manual saving of the parameter settings via device command
- Hardware and firmware updates/downgrades

> In the i550 motec inverter, the memory module is not pluggable but permanently integrated.

Automatic loading of the parameter settings when the inverter is switched on

Process when the inverter is switched on:

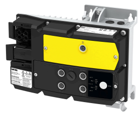
1. The default setting saved in the inverter firmware is loaded.
2. If a memory module with valid data is available, the data is loaded from the user memory.

   Otherwise a corresponding error message is output:

Error message	Info
: Memory module not present	The default setting saved in the inverter firmware is loaded. The error cannot be reset by the user. Remedy: 1. Switch off inverter. 2. Plug the memory module into the inverter. 3. Switch the inverter on again. Note: The memory module cannot be replaced during ongoing operation!
0x7682: Invalid user data	The user parameter settings in the memory module are invalid. Thus, the user parameter settings get lost. The default setting is loaded automatically. Remedy: 1. Execute user parameter settings again. 2. Execute device command "Save user data" 0x2022:003.
: Data not compl. saved before powerdown	Saving the parameter settings was interrupted by an unexpected disconnection. The user parameter settings were not saved completely. When the inverter is switched on the next time, the backup data is copied to the user memory. Remedy: 1. Check user parameter settings. (The loaded backup is an older version.) 2. If required, repeat the changes made last. 3. Execute device command "Save user data" 0x2022:003.
0x7689: Memory module: invalid OEM data	The OEM memory contains invalid parameter settings or is empty. The user parameter settings are loaded automatically. Remedy: • Execute device command "Save OEM data" 0x2022:006. • Thus, the user parameter settings get lost!

Notes:

- If the memory module contains invalid data, the device commands "Load user data" 0x2022:004 and "Load OEM data" 0x2022:005 are not executed. The status feedback "Action cancelled" takes place.
- If the memory module is empty, the default setting saved in the inverter firmware is loaded. No action is required by the user. The memory module remains empty until the device command "Save user data" 0x2022:003 or "Save OEM data" 0x2022:006 is executed.
- Irrespective of the data on the memory module, the device command "Load default settings" 0x2022:001 is always enabled.



Manual loading of the user data via device command

Device command: "Load user data" 0x2022:004

- If the user memory contains invalid parameter settings, the default setting saved in the inverter firmware is automatically loaded.
- For possible error messages, see the table above.

Manual loading of the OEM data via device command

Device command: "Load OEM data" 0x2022:005

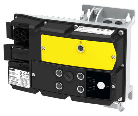
- If the OEM memory contains invalid parameter settings, the user parameter settings are loaded automatically.
- If the OEM memory is empty, the status feedback "Action cancelled" takes place. The current parameter settings remain unchanged.

Manual saving of the parameter settings via device command

Device command: "Save user data" 0x2022:003

- It may happen that the parameter settings cannot be saved because the user memory is full. In this case, the following error message appears:

Error message	Info
: Memory module is full	The memory module contains too many parameter settings. The parameter settings were not saved in the memory module. Remedy: Execute device command "Save user data" 0x2022:003 again. This reinitialises the user memory with the current parameter settings. By this means, parameter settings no longer required are deleted automatically.



Hardware and firmware upgrades/downgrades

By "taking along" the memory module, all parameter settings of a device can be transferred to another device, for instance, in case of a device replacement. When switched on, the inverter checks whether the parameter settings saved in the memory module match the inverter hardware and firmware. In case of an incompatibility, a corresponding error message is output.

The following table contains details on different scenarios:

Prio	Compatibility check User data ←→ device	Error message	Info
1	Device has a newer firmware Example: Version 2.x → version 3.x	-	The "firmware upgrade" is recognised. • The user parameter settings are loaded without an action being required by the user. • If the parameter settings are saved afterwards, the user memory is reinitialised with the current parameter settings. By this means, parameter settings no longer required are deleted automatically.
	Device has an older firmware Example: Version 4.x → version 3.x	0x7690: EPM firmware version incompatible	The data is loaded into the RAM memory but are incompatible. Remedy: 1. Execute device command "Load default settings" 0x2022:001. 2. Execute "Save user data" 0x2022:003 or "Save OEM data" 0x2022:006 device command.
2	Firmware type is different	: EPM data: firmware type incompatible	
	Power unit is different (and incompatible with saved data)	: EPM data: PU size incompatible	
	Country code is different Example: EU → USA	: EPM data: firmware type incompatible	
	Device has less functionality Examples: i550 → i510 Application I/O → Standard I/O		
3	Network option is different Example: CANopen → PROFIBUS	: EPM data: new firmware type detected	The data is loaded into the RAM memory and is compatible. However, the settings must be accepted by the user: 1. Check parameter settings. 2. Reset error. 3. Execute "Save user data" 0x2022:003 or "Save OEM data" 0x2022:006 device command.
4	Device has more functionality Examples: i510 → i550 Standard I/O → application I/O	-	The "hardware upgrade" is recognised. • The user parameter settings are loaded without an action being required by the user. • If the parameter settings are saved afterwards, the user memory is reinitialised with the current parameter settings. By this means, parameter settings no longer required are deleted automatically.
5	Power unit is different (but compatible with saved data) Example: 230 V/0.75 kW → 400 V/5.5 kW	: EPM data: new PU size detected	The data is loaded into the RAM memory and is compatible. However, the settings must be accepted by the user: 1. Check parameter settings. 2. Reset error. 3. Execute "Save user data" 0x2022:003 or "Save OEM data" 0x2022:006 device command.

14 Additional functions

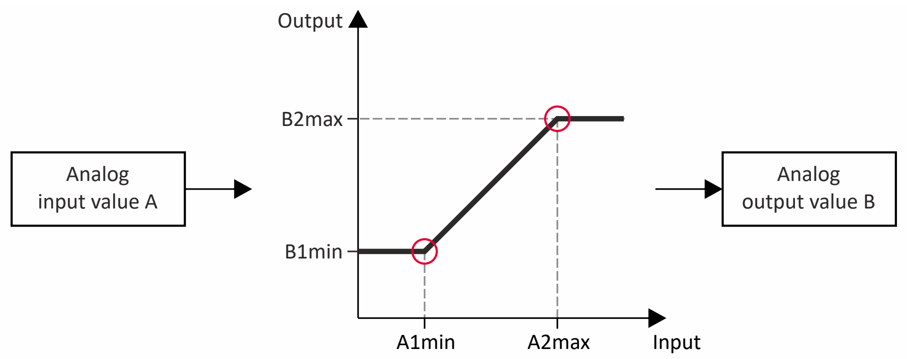
14.1 Analog signal scaling

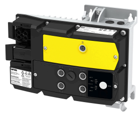
Scaling of internal analog signals (analog parameter values) for use within the inverter.

Details

Individual analog values (parameters) can be mapped to internal variables, so-called "analog signals". The analog signals can be set, among other things, as a setpoint source for frequency control or torque control.

- Two analog signals are available.
- The analog signals have a maximum size of 32 bits.
- Scaling can be parameterized for the analog signals:





14.1.1 Analog signal 1

In the default setting, the input frequency of the HTL input (0x2642:001) is set as the input value for scaling.

▶ Configure HTL input 📖 199

Intended use

The analog signal 1 can be used for the following tasks:

- As a standard setpoint source

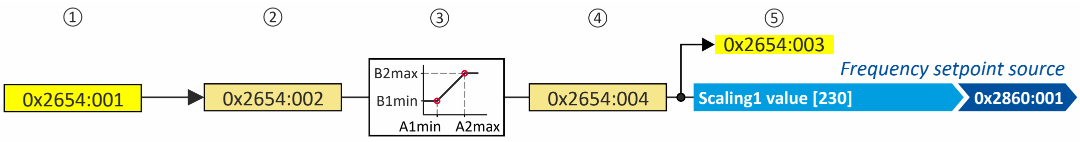
Intended use	Parameter	Setting	Further information
As a setpoint source for specifying a frequency setpoint.	0x2860:001	Scaling1 value [230]	Frequency control ▶ Standard setpoint source 📖 74
As setpoint source for defining the reference value for the process controller.	0x2860:002	Scaling1 value [230]	Frequency control ▶ Configuring the process controller 📖 80
As a setpoint source for specifying a torque setpoint.	0x2860:003	Scaling1 value [230]	Torque control ▶ Standard setpoint source 📖 99

- As an actual value source or speed feedforward source for the process controller:

Intended use	Parameter	Setting	Further information
As an actual value source for the process controller.	0x4020:002	Scaling1 value [230]	Frequency control ▶ Configuring the process controller 📖 80
As a speed feedforward source for the process controller.	0x4020:004	Scaling1 value [230]	

Details

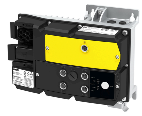
Configuration for analog signal 1:



① Source address
② Source value
③ Scaling
④ Value scaled
⑤ Optional mapping of the scaled analog signal to a parameter of the inverter

Parameter

Address	Name / setting range / [default setting]	Information
0x2654:001	Analog signal scaling: Scaling1 source address 0 ... [**641859872**] ... 4294967295	Address of the parameter whose value is to be used as analog input value for scaling.
0x2654:002	Analog signal scaling: Scaling1 source value • Read only	Display of the unscaled value.
0x2654:003	Analog signal scaling: Scaling1 target address 0 ... [**0**] ... 4294967295	Optional mapping of the scaled value to a parameter of the inverter
0x2654:004	Analog signal scaling: Scaling1 scaled value • Read only	Display of the scaled value.
0x2654:005	Analog signal scaling: Scaling1 data type input **0 Signed** 1 Unsigned	
0x2654:006	Analog signal scaling: Scaling1 bits input 2 ... [**32**] ... 32	Number of the valid bits.
0x2654:007	Analog signal scaling: Scaling1 #A1min -2147483648 ... [**0**] ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2654:008	Analog signal scaling: Scaling1 #A2min -2147483648 ... [**65535**] ... 2147483647	
0x2654:009	Analog signal scaling: Scaling1 data type output **0 Signed** 1 Unsigned	



Address	Name / setting range / [default setting]	Information
0x2654:010	Analog signal scaling: Scaling1 bits output 2 ... **[32]** ... 32	Number of the valid bits.
0x2654:011	Analog signal scaling: Scaling1 #B1min -2147483648 ... **[0]** ... 2147483647	Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2654:012	Analog signal scaling: Scaling1 #B2min -2147483648 ... **[65535]** ... 2147483647	
0x2654:015	Analog signal scaling: Scaling1 status • For further possible settings, see parameter 0x2652:015. 232 **0** **Inactive**	To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.

14.1.2 Analog signal 2

Intended use

The analog signal 2 can be used for the following tasks:

- As a standard setpoint source

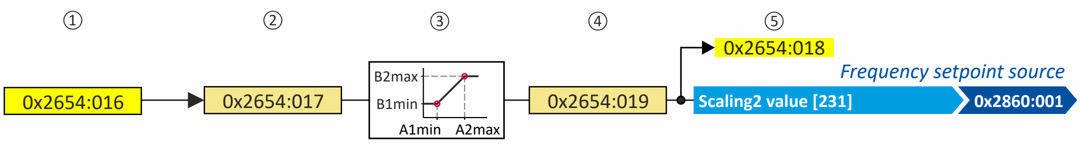
Intended use	Parameter	Setting	Further information
As a setpoint source for specifying a frequency setpoint.	0x2860:001	Scaling2 value [231]	Frequency control ▶ Standard setpoint source 74
As setpoint source for defining the reference value for the process controller.	0x2860:002	Scaling2 value [231]	Frequency control ▶ Configuring the process controller 80
As a setpoint source for specifying a torque setpoint.	0x2860:003	Scaling2 value [231]	Torque control ▶ Standard setpoint source 99

- As an actual value source or speed feedforward source for the process controller:

Intended use	Parameter	Setting	Further information
As an actual value source for the process controller.	0x4020:002	Scaling2 value [231]	Frequency control ▶ Configuring the process controller 80
As a speed feedforward source for the process controller.	0x4020:004	Scaling2 value [231]	

Details

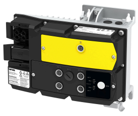
Configuration for analog signal 2:



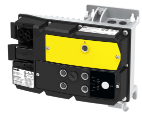
① Source address
② Source value
③ Scaling
④ Value scaled
⑤ Optional mapping of the scaled analog signal to a parameter of the inverter

Parameter

Address	Name / setting range / [default setting]	Information
0x2654:016	Analog signal scaling: Scaling2 source address 0 ... **[0]** ... 4294967295	Address of the parameter whose value is to be used as analog input value for scaling.
0x2654:017	Analog signal scaling: Scaling2 source value • Read only	Display of the unscaled value.
0x2654:018	Analog signal scaling: Scaling2 target address 0 ... **[0]** ... 4294967295	Optional mapping of the scaled value to a parameter of the inverter
0x2654:019	Analog signal scaling: Scaling2 scaled value • Read only	Display of the scaled value.
0x2654:020	Analog signal scaling: Scaling2 data type input 0 Signed **1** **Unsigned**	



Address	Name / setting range / [default setting]		Information
0x2654:021	Analog signal scaling: Scaling2 bits input 2 ... [**16**] ... 32		Number of the valid bits.
0x2654:022	Analog signal scaling: Scaling2 #A1min -2147483648 ... [**0**] ... 2147483647		Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2654:023	Analog signal scaling: Scaling2 #A2min -2147483648 ... [**65535**] ... 2147483647		
0x2654:024	Analog signal scaling: Scaling2 data type output		
	0	Signed	
	1	**Unsigned**	
0x2654:025	Analog signal scaling: Scaling2 bits output 2 ... [**16**] ... 32		Number of the valid bits.
0x2654:026	Analog signal scaling: Scaling2 #B1min -2147483648 ... [**0**] ... 2147483647		Scaling • The data range depends on the data type (signed/unsigned) and the set number of valid bits.
0x2654:027	Analog signal scaling: Scaling2 #B2min -2147483648 ... [**65535**] ... 2147483647		
0x2654:030	Analog signal scaling: Scaling2 status • For further possible settings, see parameter 0x2652:015. 232		To change the scaling of the analog value: 1. Set selection "Inactive [0]". 2. Change scaling of the analog value via the associated subcodes. 3. Set "Active [1]" selection to apply the changes. If the configuration is faulty, a corresponding status is displayed.
	0	**Inactive**	



14.2 Parameter change-over

For up to 32 freely selectable parameters, this function provides a change-over between four sets with different parameter values.

⚠ DANGER!

Unexpected response of the motor shaft while the inverter is enabled.

Changed parameter settings can become effective immediately depending on the activating method set in 0x4046.

Possible consequences: Death, severe injuries or damage to property

- If possible, only carry out parameter changes while the inverter is disabled.
- Certain device commands or settings which might cause a critical state of the drive behaviour can generally only be carried out when the inverter is inhibited.

Details

The parameter list is compiled in the same way as that of the "Favorites" via configuration. »EASY Starter« provides a user-friendly parameterisation dialog for this purpose.

Change-over to another value set can optionally be effected via corresponding device commands and/or special functions/triggers:

▸ Device commands for parameter change-over 📖 413

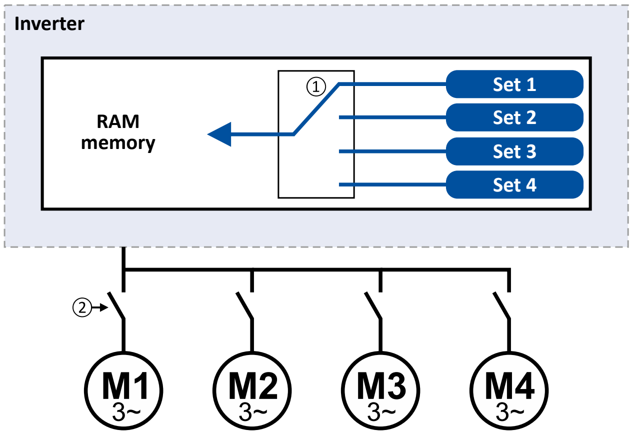
▸ Functions for parameter change-over 📖 415

14.2.1 Example: Selective control of several motors with one inverter

A typical application for the parameter change-over is an application/machine in which several axes must be triggered successively but a simultaneous operation of several motors is not required. In this case, one and the same inverter can trigger the motors in succession. Advantages of this solution are the reduced amount of components (inverters) and a reduced energy consumption.

Principle:

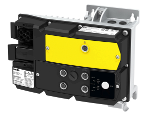
- The motor to be currently controlled is connected to the inverter via motor contactors. (The contactor system can, for instance, be controlled via the digital outputs of the inverter.)
- At the same time, the motor and control settings suitable for motor are activated in the inverter by means of parameter change-over.



□ Motor data change-over (via the "parameter change-over" function)
□ Motor change-over (e.g. via motor contactors)

The following table lists all parameters that require different settings for the four motors:

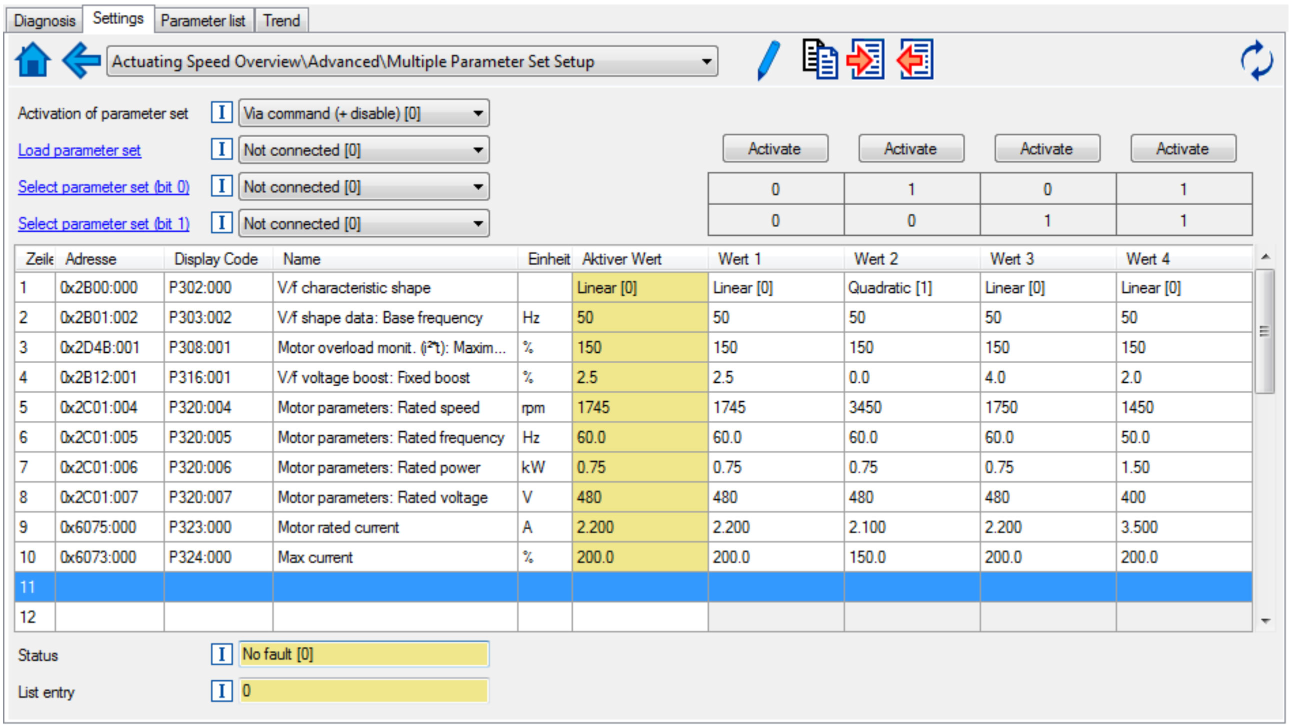
#	Parameter	Name	Setting			
			M1	M2	M3	M4
1	0x2B00	V/f characteristic shape	Linear [0]	Square-law [1]	Linear [0]	Linear [0]
2	0x2B01:002	Base frequency	60 Hz	60 Hz	60 Hz	50 Hz
3	0x2D4B:001	Maximum utilisation [60 s]	150 %	120 %	150 %	150 %
4	0x2B12:001	Fixed boost	2.5 %	0.0 %	4.0 %	2.0 %
5	0x2C01:004	Rated speed	1745	3450	1750	1450
6	0x2C01:005	Rated frequency	60.0 Hz	60.0 Hz	60.0 Hz	50.0 Hz
7	0x2C01:006	Rated power	0.75 kW	0.75 kW	0.75 kW	1.50 kW
8	0x2C01:007	Rated voltage	480 V	480 V	480 V	400 V
9	0x6075	Rated motor current	2,200 A	2,100 A	2,200 A	3,500 A
10	0x6073	Max. current	200.0 %	150.0 %	200.0 %	200.0 %



Settings required for the "parameter change-over" function

The easiest way to make the required settings is via the parameterization dialog in the »EASY Starter«:

1. Click the button to first select the 10 relevant parameters.
2. Set values for motor M1 ... M4 in the corresponding fields:

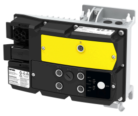


In case of a direct setting in the parameters of the "parameter change-over" function:

- The addresses must be set in the following: 0xiiiiss00 (iiii = hexadecimal index, ss = hexadecimal subindex)
- The values for the motors must be set as integer values. The integer value results from the multiplication of the actual setting value by the factor of the respective parameter. In the table of attributes, the factor for each parameter must be given.

The following table shows the required settings:

#	Address 0x4041:x		Name	Value 1 0x4042:x	Value 2 0x4043:x	Value 3 0x4044:x	Value 4 0x4045:x
	hex	decimal					
1	0x2B000000	721420288	V/f characteristic shape	0	1	0	0
2	0x2B010200	721486336	Base frequency	60	60	60	50
3	0x2D4B0100	759890176	Maximum utilisation [60 s]	150	120	150	150
4	0x2B120100	722600192	Fixed boost	25	0	40	20
5	0x2C010400	738264064	Rated speed	1745	3450	1750	1450
6	0x2C010500	738264320	Rated frequency	600	600	600	500
7	0x2C010600	738264576	Rated power	75	75	75	150
8	0x2C010700	738264832	Rated voltage	480	480	480	400
9	0x60750000	1618280448	Rated motor current	2200	2100	2200	3500
10	0x60730000	1618149376	Max. current	2000	1500	2000	2000



14.2.2 Parameter set configuration

Parameter

Address	Name / setting range / [default setting]		Information
0x4041:001 ... 0x4041:032	Parameter change-over: Parameter 1 ... Parameter 32 0 ... [**0**] ... 4294967040		Definition of the parameter list for the "Parameter change-over" function. • Format: 0xiiiiss00 (iiii = hexadecimal index, ss = hexadecimal subindex) • The lowest byte is always 0x00.
0x4042:001 ... 0x4042:032	Parameter value set 1: Value of parameter 1 ... Value of parameter 32 -2147483648 ... [**0**] ... 2147483647		Value set 1 for the parameter list defined in 0x4041:001 ... 0x4041:032.
0x4043:001 ... 0x4043:032	Parameter value set 2: Value of parameter 1 ... Value of parameter 32 -2147483648 ... [**0**] ... 2147483647		Value set 2 for the parameter list defined in 0x4041:001 ... 0x4041:032.
0x4044:001 ... 0x4044:032	Parameter value set 3: Value of parameter 1 ... Value of parameter 32 -2147483648 ... [**0**] ... 2147483647		Value set 3 for the parameter list defined in 0x4041:001 ... 0x4041:032.
0x4045:001 ... 0x4045:032	Parameter value set 4: Value of parameter 1 ... Value of parameter 32 -2147483648 ... [**0**] ... 2147483647		Value set 4 for the parameter list defined in 0x4041:001 ... 0x4041:032.
0x4047:001	Parameter change-over error message: Status • Read only		Error message for the "parameter change-over" function. • In the event of an error, an error status is shown here, and in 0x4047:002 the number of the list entry in which the error has occurred is displayed (in connection with the value set selected). • If several errors occur at the same time, only the first incorrect list entry will be displayed. Hence, after elimination of the displayed error and repeated activation, more errors may be displayed. • The parameter list will always be processed from beginning to end, even if errors occur in the meantime.
	0	No fault	
	33803	Invalid data type	
	33804	Range violation	
	33806	Invalid index	
	33813	No element selected	
	33815	Writing impermissible	
	33816	Device not inhibited	
	33829	Invalid subindex	
	33837	Access impermissible	
	33860	Parameter not mappable	
	33865	No subindexes	
	33876	Parameter not changeable	
0x4047:002	Parameter change-over error message: List entry • Read only		Error message for the "Parameter set changeover" function. • In the event of an error, the number of the list entry for which the error displayed in 0x4047:001 has occurred is shown here.

14.2.3 Device commands for parameter change-over

The parameter set can be selected with the device commands "Load parameter set 1" ... "Load parameter set 4".

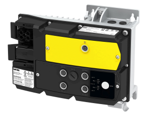
Details

The change-over via the device commands depends on the activation method set in 0x4046:

- Activation method = 1 or 3: Change-over takes place immediately.
- Activation method = 0 or 2: The respective device command is only executed if the inverter is disabled.

Parameter

Address	Name / setting range / [default setting]		Information
0x2022:007	Device commands: Load parameter set 1		1 = load value set 1 of the "Parameter change-over" function. • The parameters specified in 0x4041/1...32 are set to the values set in 0x4042/1...32. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	



Address	Name / setting range / [default setting]		Information
0x2022:008	Device commands: Load parameter set 2		1 = load value set 2 of the "Parameter change-over" function. • The parameters specified in 0x4041/1...32 are set to the values set in 0x4043/1...32. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:009	Device commands: Load parameter set 3		1 = load value set 3 of the "Parameter change-over" function. • The parameters specified in 0x4041/1...32 are set to the values set in 0x4044/1...32. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:010	Device commands: Load parameter set 4		1 = load value set 4 of the "Parameter change-over" function. • The parameters specified in 0x4041/1...32 are set to the values set in 0x4045/1...32. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:011	Device commands: Save parameter set 1		1 = save value set 1 of the "Parameter change-over" function. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:012	Device commands: Save parameter set 2		1 = save value set 2 of the "Parameter change-over" function. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:013	Device commands: Save parameter set 3		1 = save value set 3 of the "Parameter change-over" function. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	
0x2022:014	Device commands: Save parameter set 4		1 = save value set 3 of the "Parameter change-over" function. • When the device command has been executed successfully, the value 0 is shown.
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	

14.2.4 Functions for parameter change-over

The parameter set can be selected with the functions "Select parameter set (bit 0)" and "Select parameter set (bit 1)".

Details

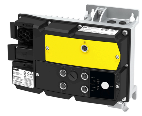
A value set is selected in a binary-coded fashion via the triggers assigned to the two Select parameter set (bit 0)" and " Select parameter set (bit 1)" functions in compliance with the following truth table:

Select parameter set (bit 1) 0x2631:042	Select parameter set (bit 0) 0x2631:041	Selection
FALSE	FALSE	Value set 1
FALSE	TRUE	Value set 2
TRUE	FALSE	Value set 3
TRUE	TRUE	Value set 4

Change-over is effected depending on the activation method selected in 0x4046 when a state change of the selection inputs takes place or via the trigger assigned to the "Load parameter set" function.

Parameter

Address	Name / setting range / [default setting]	Information
0x2631:040	Function list: Load parameter set • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Load parameter set" function. Trigger = FALSE-TRUE edge: parameter change-over to the value set selected via "Select parameter set (bit 0)" and "Select parameter set (bit 1)". Trigger = FALSE: no action. Notes: • The activation method for the "Parameter change-over" function can be selected in 0x4046.
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:041	Function list: Select parameter set (bit 0) • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Select parameter set (bit 0)" function. Selection bit with the valency 2^0 for "Parameter change-over" function. Trigger = FALSE: selection bit = "0". Trigger = TRUE: selection bit = "1".
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).
0x2631:042	Function list: Select parameter set (bit 1) • Setting can only be changed if the inverter is disabled. • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Select parameter set (bit 1)" function. Selection bit with the valency 2^1 for "Parameter change-over" function. Trigger = FALSE: selection bit = "0". Trigger = TRUE: selection bit = "1".
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).

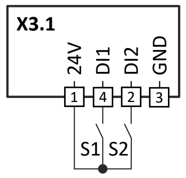


Address	Name / setting range / [default setting]		Information
0x4046	Activation of parameter set		Selection of the activation method for the parameter change-over. • If the selection is changed from "Via command... [0]/[1]" to "If the selection is changed...[2]/[3]" after switch-on, the parameter set selected via the functions "Select parameter set (bit 0)" and "Select parameter set (bit 1)" is activated immediately. In case of selection [2], however, this only takes place if the inverter is disabled, the motor is stopped or an error is active.
	0	**Via command (disable required)**	The parameter set selected via the functions "Select parameter set (bit 0)" and "Select parameter set (bit 1)" is activated if the trigger assigned to the "Load parameter set" function in 0x2631:040 provides a FALSE-TRUE edge AND the inverter is inhibited, the motor is stopped or an error is active. ▸ Example: Activation via command (only when disabled) 417
	1	Via command (immediately)	The parameter set selected via the functions "Select parameter set (bit 0)" and "Select parameter set (bit 1)" is immediately activated if the trigger assigned to the "Load parameter set" function in 0x2631:040 provides a FALSE-TRUE edge. ▸ Example: Activation via command (immediately) 418
	2	If the selection is changed (disable required)	The parameter set selected via the functions "Select parameter set (bit 0)" and "Select parameter set (bit 1)" is activated if the state of these selection bits changes AND the inverter is inhibited, the motor is stopped or an error is active. ▸ Example: Activation if the selection is changed (only if the inverter is disabled) 419
	3	If the selection is changed (immediately)	The parameter set selected via the functions "Select parameter set (bit 0)" and "Select parameter set (bit 1)" is activated immediately if the state of these selection bits is changed. ▸ Example: Activation if the selection is changed (immediately) 420

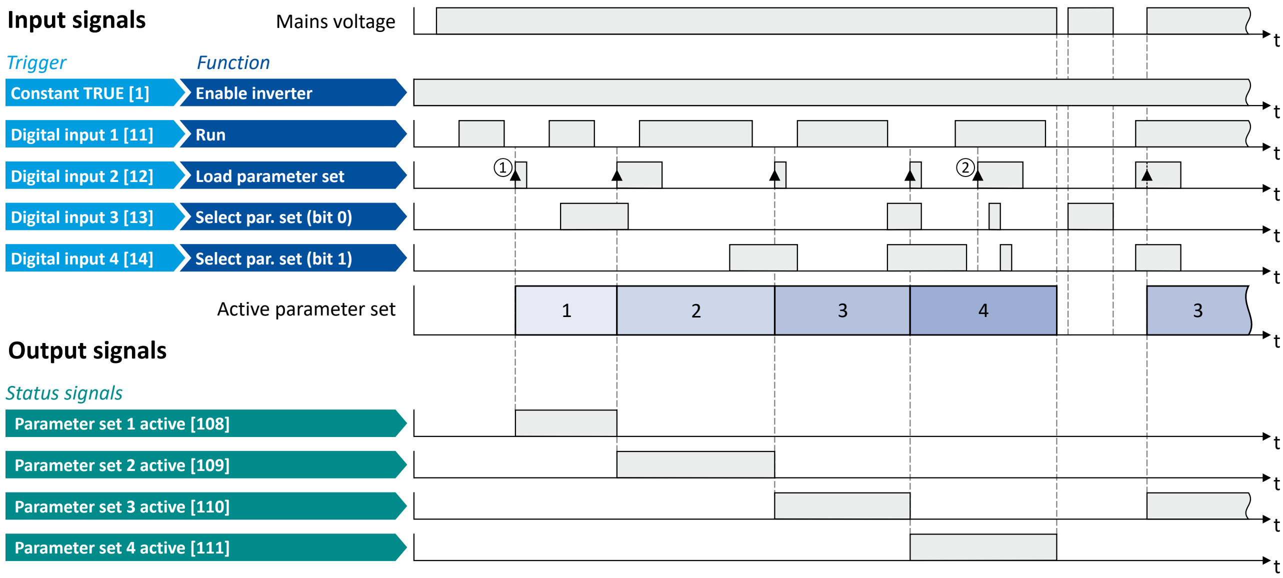
14.2.4.1 Example: Activation via command (only when disabled)

Activation method 0x4046 = "Via command (disable required) [0]":

- The parameter set is selected via switches S3 and S4 (see following table).
- Switch S2 activates the changeover. Since the changeover is activated with a rising edge, a button (normally-open contact) can be used instead of a switch.
- Changeover is only possible if the motor is not started (switch S1 open).

Connection diagram	Function			
	Switch S1	Run		
	Switch S2	Load parameter set		
	Switch S3 ... S4	Parameter set selection:		
		S3	**S4**	
		Off	Off	Parameter set 1
		On	Off	Parameter set 2
		Off	On	Parameter set 3
		On	On	Parameter set 4

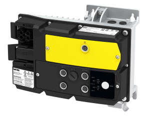
Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:040	Load parameter set	Digital input 2 [12]
0x2631:041	Select parameter set (bit 0)	Digital input 3 [13]
0x2631:042	Select parameter set (bit 1)	Digital input 4 [14]
0x4046	Activation of parameter set	Via command (disable required) [0]



The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① The changeover is activated with the "Load parameter set" function (FALSE/TRUE edge).

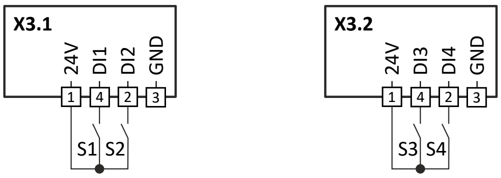
② If the inverter is enabled and the motor is started, a change-over is not possible.



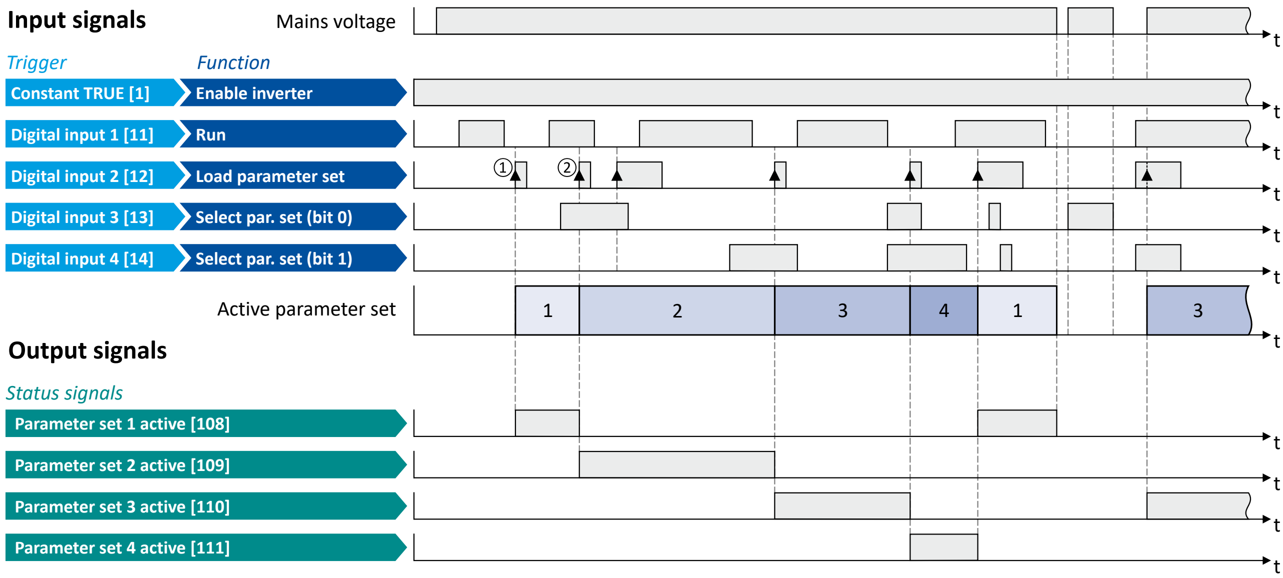
14.2.4.2 Example: Activation via command (immediately)

Activation method 0x4046 = "Via command (immediately) [1]":

- The parameter set is selected via switches S3 and S4 (see following table).
- Switch S2 activates the changeover. Since the changeover is activated with a rising edge, a button (normally-open contact) can be used instead of a switch.
- Changeover takes place immediately, even if the motor is started (switch S1 closed).

Connection diagram	Function			
	Switch S1	Run		
	Switch S2	Load parameter set		
	Switch S3 ... S4	Parameter set selection:		
		S3	**S4**	
		Off	Off	Parameter set 1
		On	Off	Parameter set 2
		Off	On	Parameter set 3
		On	On	Parameter set 4

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:040	Load parameter set	Digital input 2 [12]
0x2631:041	Select parameter set (bit 0)	Digital input 3 [13]
0x2631:042	Select parameter set (bit 1)	Digital input 4 [14]
0x4046	Activation of parameter set	Via command (immediately) [1]



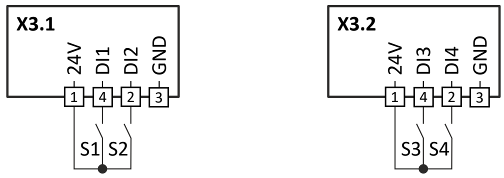
The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① The changeover is activated with the "Load parameter set" function (FALSE/TRUE edge).
② Changeover is also possible when the inverter is enabled and the motor has started.

14.2.4.3 Example: Activation if the selection is changed (only if the inverter is disabled)

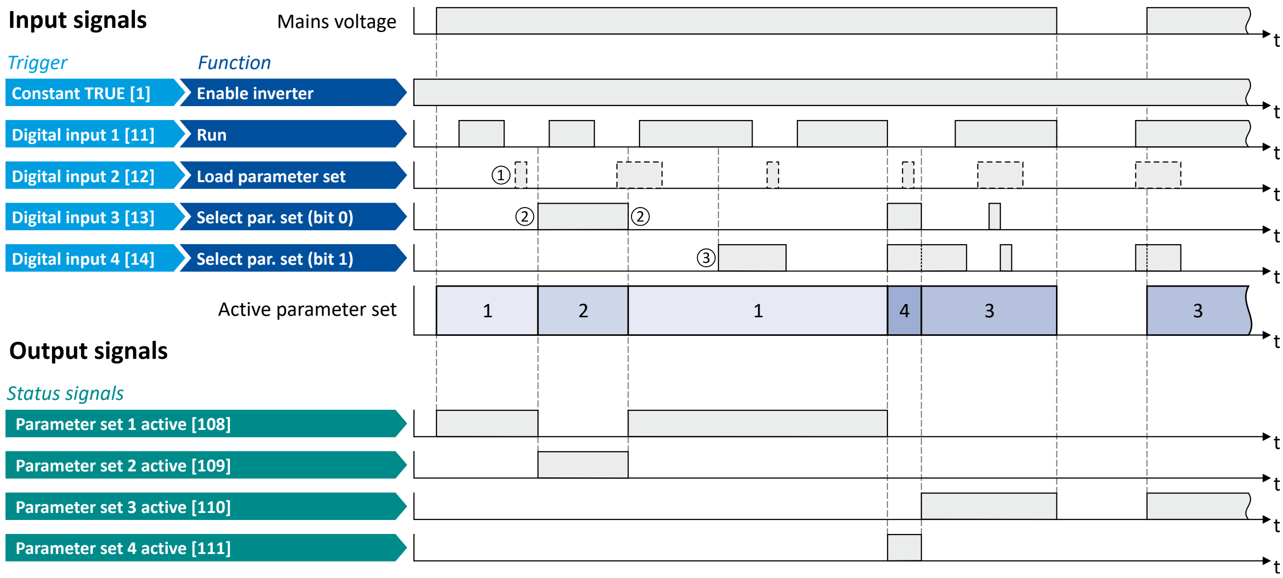
Activation method 0x4046 = "If the selection is changed (disable required) [2]":

- The parameter set is selected via switches S3 and S4 (see following table). At the same time, a change of state of the selection inputs activates the changeover.
- Changeover is only possible if the motor is not started (switch S1 open).
- Switch S2 ("Load parameter set") is ignored in this configuration.

Connection diagram	Function	
	Switch S1	Run
	Switch S2	Load parameter set (is ignored in this configuration)
	Switch S3 ... S4	Parameter set selection and activation at the same time:

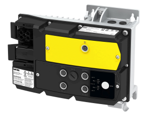
S3	S4	
Off	Off	Parameter set 1
On	Off	Parameter set 2
Off	On	Parameter set 3
On	On	Parameter set 4

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:040	Load parameter set	Digital input 2 [12]
0x2631:041	Select parameter set (bit 0)	Digital input 3 [13]
0x2631:042	Select parameter set (bit 1)	Digital input 4 [14]
0x4046	Activation of parameter set	If the selection is changed (disable required) [2]



The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

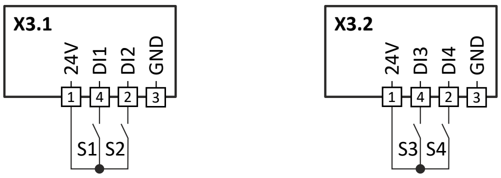
① The "Load parameter set" function is ignored in this configuration.
② Changeover takes place by a status change of the selection inputs.
③ If the inverter is enabled and the motor is started, a change-over is not possible.



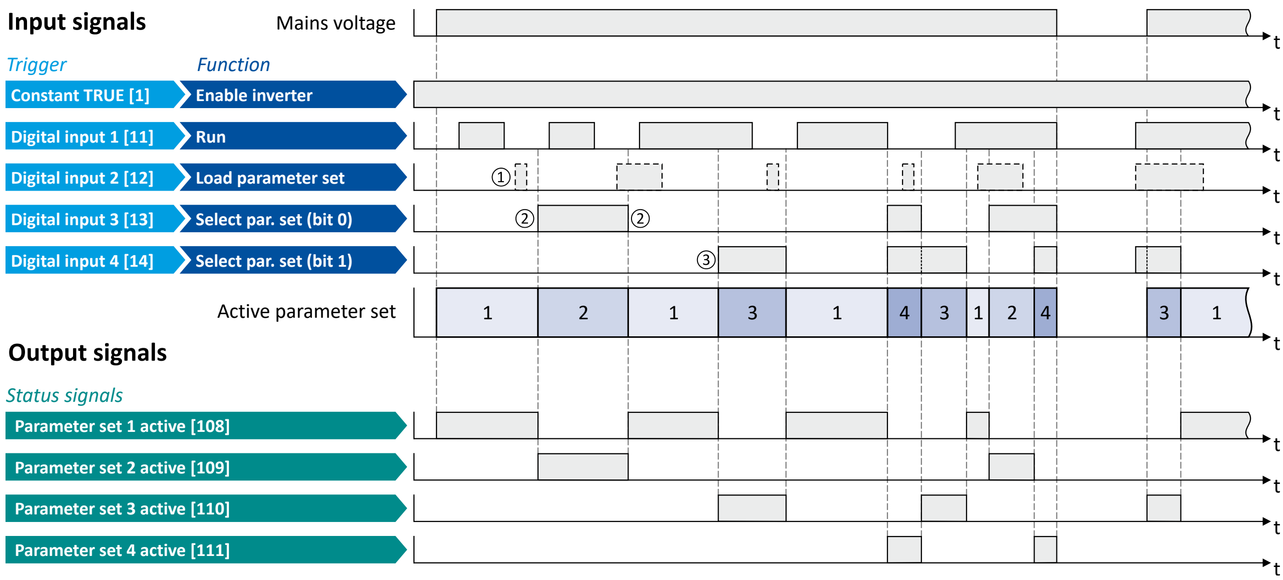
14.2.4.4 Example: Activation if the selection is changed (immediately)

Activation method 0x4046 = "If the selection is changed (immediately) [3]":

- The parameter set is selected via switches S3 and S4 (see following table). At the same time, a change of state of the selection inputs activates the changeover.
- Changeover takes place immediately, even if the motor is started (switch S1 closed).
- Switch S2 ("Load parameter set") is ignored in this configuration.

Connection diagram	Function		
	Switch S1	Run	
	Switch S2	Load parameter set (is ignored in this configuration)	
	Switch S3 ... S4	Parameter set selection and activation at the same time:	
		S3	**S4**	
		Off	Off	Parameter set 1
		On	Off	Parameter set 2
		Off	On	Parameter set 3
		On	On	Parameter set 4

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Not connected [0]
0x2631:040	Load parameter set	Digital input 2 [12]
0x2631:041	Select parameter set (bit 0)	Digital input 3 [13]
0x2631:042	Select parameter set (bit 1)	Digital input 4 [14]
0x4046	Activation of parameter set	If the selection is changed (immediately) [3]



The status signals can be assigned to digital outputs. ▶ Configure digital outputs 📖 194

① The "Load parameter set" function is ignored in this configuration.
② Changeover takes place by a status change of the selection inputs.
③ Changeover is also possible when the inverter is enabled and the motor has started.

14.3 Trigger action if a frequency threshold is exceeded

As a function of the current output frequency, the adjustable frequency threshold serves to trigger a certain function or set a digital output.

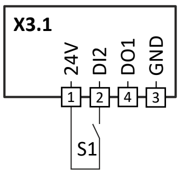
Parameter

Address	Name / setting range / [default setting]	Information
0x4005	Frequency threshold 0.0 ... [**0.0**] ... 1000.0 Hz	Threshold for the "Frequency threshold exceeded [70]" trigger. • The "Frequency threshold exceeded [70]" trigger is TRUE if the current output frequency is higher than the set threshold. • The trigger can be assigned to a function or to a digital output.

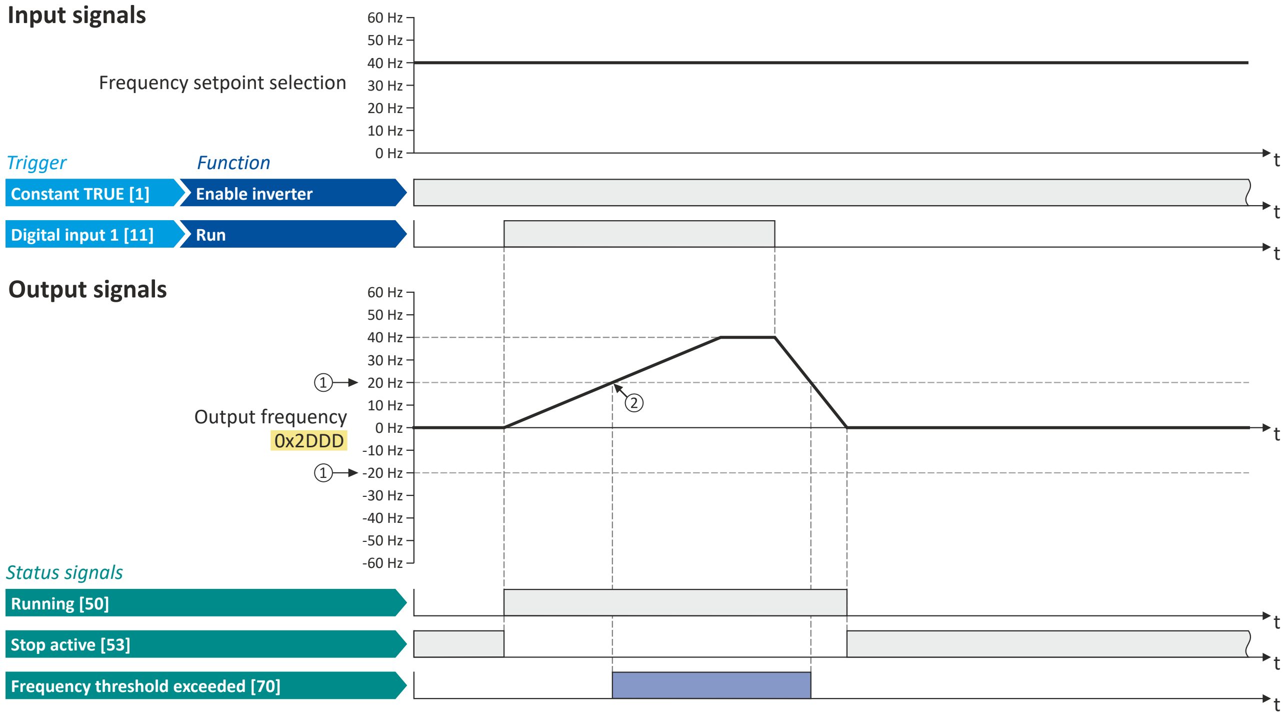
Example for operating mode

In the following example, the digital output 1 is set to TRUE if the output frequency is higher than 20 Hz.

- As standard setpoint source, preset 1 (40 Hz) is set.
- Switch S1 starts the motor in forward direction of rotation. Switch S1 in initial position stops the motor again.

Connection diagram	Function	
	Switch S1	Run

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DO1 [2]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2634:002	Digital outputs function: Digital output 1	Frequency threshold exceeded [70]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz
0x291D:001	Acceleration time 1	9.00 s
0x291D:002	Deceleration time 1	3.00 s
0x4005	Frequency threshold	20.0 Hz



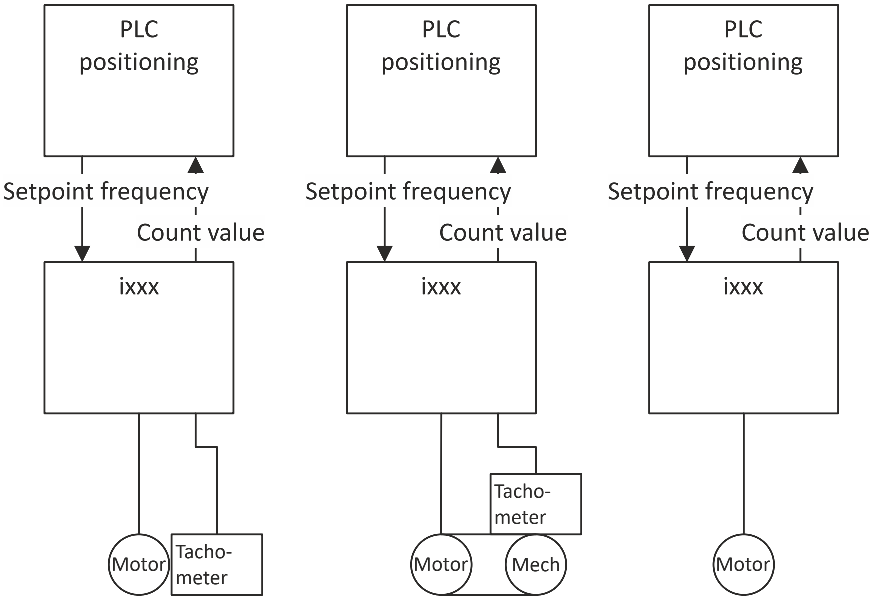
The status signals can be assigned to digital outputs. ▶ Configure digital outputs 194

① Frequency threshold 0x4005

② Frequency threshold exceeded: Via trigger "Frequency threshold exceeded [70]", the digital output 1 is set to TRUE.

14.4 Position counter

This function counts the number of motor revolutions. The current counter content (actual position) can be output as process data value via network to implement a simple position control in a higher-level Controller.

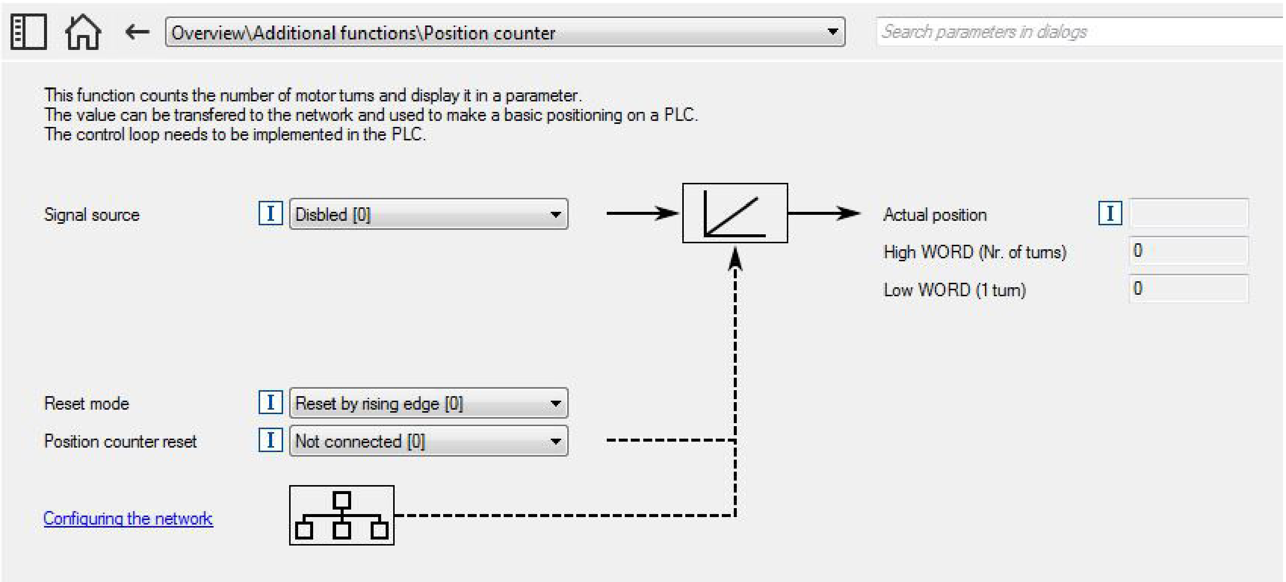


Preconditions

- Connector X3.2 must be configured as encoder input. ▶ Configure function assignment 📖 188
- The encoder input must be configured according to the connected encoder. ▶ Configure encoder input 📖 110
- As an alternative, the number of motor revolutions from the motor model can be reconstructed. For this purpose, the motor control type "Sensorless control for synchronous motors (SLSM-PSM) [8]" must be selected and set in 0x2C00.
- The position control must be implemented in the controller.

Details

The signal source for the position counter is selected in 0x2C49:001. The position counter can count forwards and backwards. The current counter content (actual position) is displayed in 0x2C49:003. After the maximum or minimum value has been reached, an overflow takes place.



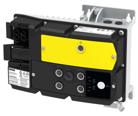
Reset position counter:

- The position counter is reset when the supply voltage is switched on.
- The position counter can be reset manually via the "Position counter reset" 0x2631:054 function or the NetWordIN1 0x4008:001 data word. For a reset via NetWordIN1, the "Position counter reset [54]" function must be assigned to a bit of the data word. Depending on the selection in 0x2C49:002, the reset can be made either edge-controlled or status-controlled.

Parameter

Address	Name / setting range / [default setting]	Information
0x2631:054	Function list: Position counter reset • Further possible settings: ▸ Trigger list 📖 58	Assignment of a trigger for the "Position counter reset" function. Trigger = FALSE-TRUE edge: Reset position counter manually. Trigger = FALSE: no action. Notes: • In 0x2C49:002 it can be selected whether the reset is to be effected edge-controlled (default setting) or status-controlled.
	0 **Not connected**	No trigger assigned (trigger is constantly FALSE).

Address	Name / setting range / [default setting]		Information
0x2C49:001	Position counter: Signal source		Selection of the signal source for the position counter.
	0	**Disbled**	Position counter is deactivated.
	1	Digital inputs DI3/DI4	The motor revolutions are counted that are provided by an HTL encoder connected to the digital inputs DI3/DI4. • A motor revolution always equals the increments/revolution set in 0x2C42:001 for the HTL encoder. This applies to all types of HTL encoders that can be set in 0x2630:011: "Encoder [0]", "Low resolution HTL encoder [15]", and "Pulse-In... [16 ... 19]". • The counter reading is also updated when the power stage is switched off. • If an HTL encoder is used without detecting the direction of rotation, it is only counted forwards.
	2	External position	
	5	Internal motor model	The motor revolutions reconstructed from the internal motor model of the sensorless control (SL PSM) are counted. • The counter content will not be updated if the power section is switched off. • After restarting the power section, the counting of the last counter content is continued.
0x2C49:002	Position counter: Reset mode		Selection if the manual reset of the position counter is to be effected edge-controlled or status-controlled.
	0	**Reset by rising edge**	
	1	Reset by signal state true	
0x2C49:003	Position counter: Actual position • Read only		Mappable parameter for providing the current counter content (actual position) via network. Scaling (applies to every measuring method or encoder resolution): • Upper 16 bits: Counted revolutions (0 ... 65535, overflow possible) • Lower 16 bits: Current position within the revolution (0 ... 65535)
0x2C49:004	Position counter: External position • Read only		



15 Safety functions

Supported safety functions for "Basic Safety - STO"

▸ Safe torque off (STO) 📖 427

15.1 Safe torque off (STO)

This function corresponds to a "Stop 0" according to EN 60204.

The motor cannot generate torque and movements of the drive.

⚠ DANGER!

The power supply is not safely disconnected.

Possible consequences: Death or serious injury due to electrical voltage

- Turn off the power supply.

⚠ DANGER!

Automatic restart if the request of the safety function is deactivated.

Possible consequences: Death or severe injuries

- You must provide external measures according to EN ISO 13849-1 which ensure that the drive only restarts after a confirmation.

Preconditions

Inverter with I5MASA000 safety module

Functional description

How to safely disconnect the drive:

1. A safety sensor requests the safety function.
2. The transmission of the pulse width modulation is safely switched off by the safety unit. The power drivers do not generate a rotating field anymore.
3. The inverter switches to the STO active device status (status word 0x6041, Bit15 = 0).

The motor is safely switched to torqueless operation (STO).

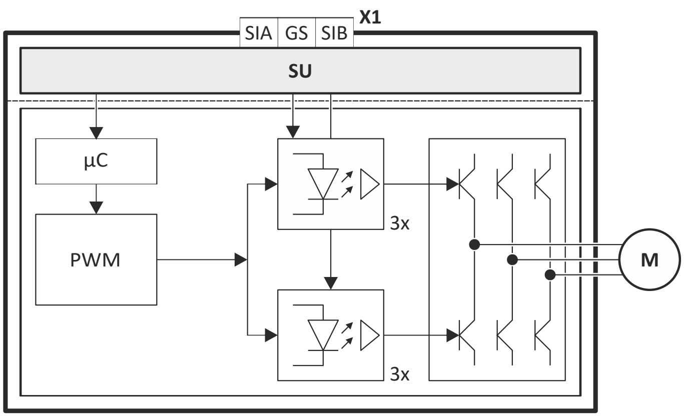
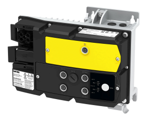


Fig. 8: Functional principle: Basic Safety - STO

X1	Control terminals of the safety unit	PWM	Pulse width modulation
SU	Hardware interface	M	Motor
µC	Microcontroller		



Function chart

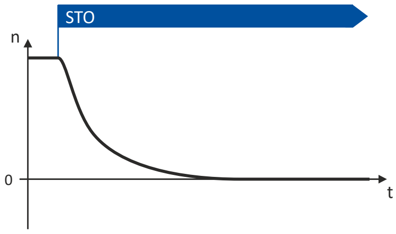


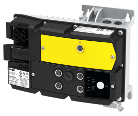
Fig. 9: Safety function STO

Functional sequence and error response have no adjustable parameters.

Truth table

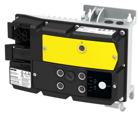
Safe input / channel		Inverter	Inverter status word 0x282A:004		CiA status word
SIA	**SIB**	**Device state**	**Bit 10**	**Bit 11**	**Object 0x6041, bit 15**
LOW	LOW	STO active	1	1	0
LOW	HIGH	Impermissible state, drive disabled	1	0	0
HIGH	LOW		1	0	0
HIGH	HIGH	Drive enabled	0	0	1

If the GS connection is interrupted, or in case of a short circuit/cross-circuit of GS to SIA/SIB, STO is active.



16 Diagnostics and fault elimination

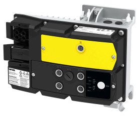
This section contains information on error handling, drive diagnostics and fault analysis.



16.1 LED status display

You can quickly obtain information on some operating states via the large "DRIVE" LED status display on the inverter. This status display is composed of a blue LED "RDY" and a red LED "ERR", which emit specific blinking patterns depending on the operating status:

"RDY" LED (blue)	"ERR" LED (red)	Status/meaning
Off	Off	Supply voltage not available.
On	On	Initialisation in progress (inverter is being started.)
Blinks (1 Hz)	Off	Safe torque off (STO) active. The inverter has been inhibited by the integrated safety system. ▸ Safe torque off (STO) 427
Blinks (1 Hz)	On	Inverter inhibited, error active. ▸ Error handling 443
On	Off	Inverter enabled. **Motor rotates according to the specified setpoint or quick stop is active.**
Both LEDs are blinking in a rapidly alternating mode		Firmware update active. ▸ Update device firmware 401
Both LEDs are blinking in a very rapidly synchronous mode		"Visual tracking" function is active. ▸ Optical device identification 388



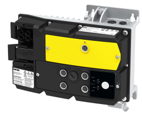
16.2 Logbook

With the logbook, the controller has access to the last 32 messages of the inverter.

- The logbook is saved persistently in the inverter.
- The logbook has a ring buffer structure:
  - As long as free memory is available in the logbook, a message is entered following the next free memory unit.
  - When all memory units are occupied, the oldest message is deleted for a new message.
  - Always the most recent messages remain available.
- On the basis of the "Diag code" (32-bit word) of each individual message it can be seen which axis the message refers to.

Parameter

Address	Name / setting range / [default setting]		Information
0x2022:015	Device commands: Delete logbook		• When the device command has been executed successfully, the value 0 is shown. • Do not switch off the supply voltage during the deletion process and do not unplug the memory module!
	0	**Off / ready**	Only status feedback
	1	On / start	Execute device command
	2	In progress	Only status feedback
	3	Action cancelled	



16.3 Error history buffer

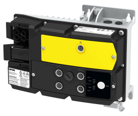
For diagnostic purposes, the error history memory contains the last 32 error and warning messages of the inverter that occurred during operation. The error history memory represents a limited view of the logbook.

Details

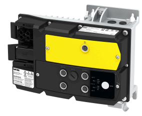
- For each event that is recorded, the error history buffer contains the message text, the error code, the time of occurrence as well as a counter for successive, identical events. If an event that has already been recorded occurs repeatedly, only the counter is incremented.
- The error history buffer can be reset by the user. In order to prevent the buffer from being reset by the user, this function can be protected by means of a password.
- Observe that the error history buffer only presents a snapshot at the time the data are read out. If a new event occurs, the error history buffer must be read out again via the parameters listed below so that the new event becomes visible.

Parameter

Address	Name / setting range / [default setting]	Information
0x2006:000	Error history buffer: Keypad display • Read only	
0x2006:001	Error history buffer: Maximum number of messages • Read only	Display of the maximum number of messages which can be stored in the history buffer (from subindex 6).
0x2006:002	Error history buffer: Latest message • Read only	Display of the subindex of the most recent message.
0x2006:003	Error history buffer: Latest acknowledgement message 0 ... [**0**] ... 255	0 = delete all entries in the error history buffer.
0x2006:004	Error history buffer: New message • Read only	Reserved for future extensions.
0x2006:005	Error history buffer: Configuration/Status 0 ... [**1**] ... 65535 Bit 0 Send emergency message Bit 1 Disable info message Bit 2 Disable warning message Bit 3 Disable error message Bit 4 Mode selection Bit 5 Message overwritten	Bit 0 ... bit 4 = 0. Bit 5 = 1 = overflow (after recording the 33rd event in the error history buffer.
0x2006:006	Error history buffer: Message 0 • Read only	Error history buffer entry 01 (latest event)
0x2006:007	Error history buffer: Message 1 • Read only	Error history buffer entry 02
0x2006:008	Error history buffer: Message 2 • Read only	Error history buffer entry 03
0x2006:009	Error history buffer: Message 3 • Read only	Error history buffer entry 04
0x2006:010	Error history buffer: Message 4 • Read only	Error history buffer entry 05
0x2006:011	Error history buffer: Message 5 • Read only	Error history buffer entry 06
0x2006:012	Error history buffer: Message 6 • Read only	Error history buffer entry 07
0x2006:013	Error history buffer: Message 7 • Read only	Error history buffer entry 08
0x2006:014	Error history buffer: Message 8 • Read only	Error history buffer entry 09



Address	Name / setting range / [default setting]	Information
0x2006:015	Error history buffer: Message 9 • Read only	Error history buffer entry 10
0x2006:016	Error history buffer: Message 10 • Read only	Error history buffer entry 11
0x2006:017	Error history buffer: Message 11 • Read only	Error history buffer entry 12
0x2006:018	Error history buffer: Message 12 • Read only	Error history buffer entry 13
0x2006:019	Error history buffer: Message 13 • Read only	Error history buffer entry 14
0x2006:020	Error history buffer: Message 14 • Read only	Error history buffer entry 15
0x2006:021	Error history buffer: Message 15 • Read only	Error history buffer entry 16
0x2006:022	Error history buffer: Message 16 • Read only	Error history buffer entry 17
0x2006:023	Error history buffer: Message 17 • Read only	Error history buffer entry 18
0x2006:024	Error history buffer: Message 18 • Read only	Error history buffer entry 19
0x2006:025	Error history buffer: Message 19 • Read only	Error history buffer entry 20
0x2006:026	Error history buffer: Message 20 • Read only	Error history buffer entry 21
0x2006:027	Error history buffer: Message 21 • Read only	Error history buffer entry 22
0x2006:028	Error history buffer: Message 22 • Read only	Error history buffer entry 23
0x2006:029	Error history buffer: Message 23 • Read only	Error history buffer entry 24
0x2006:030	Error history buffer: Message 24 • Read only	Error history buffer entry 25
0x2006:031	Error history buffer: Message 25 • Read only	Error history buffer entry 26
0x2006:032	Error history buffer: Message 26 • Read only	Error history buffer entry 27
0x2006:033	Error history buffer: Message 27 • Read only	Error history buffer entry 28
0x2006:034	Error history buffer: Message 28 • Read only	Error history buffer entry 29
0x2006:035	Error history buffer: Message 29 • Read only	Error history buffer entry 30
0x2006:036	Error history buffer: Message 30 • Read only	Error history buffer entry 31
0x2006:037	Error history buffer: Message 31 • Read only	Error history buffer entry 32



Structure of the messages

The following example shows the detailed structure of one of the following messages (parameter 0x2006:006 ... 0x2006:037):

Message:	00E01043120199000520B0473FC010000500 01					
	00E01043	1201	9900	00520B0473FC0100	0500	01
Meaning:	Diag code	Message type	Text ID	Time stamp in [ns]	Flag param. 1	Parameter 1
Data type:	U32	U16	U16	U64	U16	U8
Hex value:	0x4310 E000	0x0112	0x0099	0x0001 FC73 040B 5200	0x0005	0x01

Notes:

- The upper 16 bits of the "Diag Code" contain the error code (in the example "0x4310").
- Bit 0 ... 3 of the message type contain the error type (0: Info, 1: Warning, 2: Trouble, 3: Fault).
- Convert time stamp: 0x0001 FC73 040B 5200 = 559045896000000 ns = 6 days, 11 hours, 17 minutes, 25 seconds
- The flag for parameter 1 has no meaning for decoding the message.
- The parameter 1 contains the counter for successive, identical events.

16.3.1 Read out error history buffer

There are two different options to read individual messages of the "error history memory" (in the logbook) from an external control or visualization system:

a) Via the standard path defined by "ETG 1020" (EtherCat Technology Group)

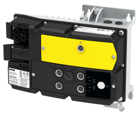
b) Via simple parameter access to messages in the "error history memory"

Option (b) is described here.

You read diagnostic messages via simple parameter access to the "error history memory".

Parameter

Address	Name / setting range / [default setting]		Information
0x2007:001	Error history buffer: Message number 1 ... [**1**] ... 32		
0x2007:002	Error history buffer: Time stamp • Read only: x.xx s		
0x2007:003	Error history buffer: Response to error • Read only		
	0	No response	▸ Error types 📖 444
	11	Information	
	12	Warning	
	16	Trouble	
	23	Fault	
0x2007:004	Error history buffer: Message ID • Read only		
0x2007:005	Error history buffer: Diag Code Ident • Read only		
0x2007:006	Error history buffer: Message counter • Read only		



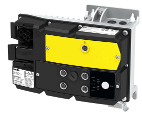
16.4 Diagnostic parameters

The inverter provides many diagnostic parameters which are helpful for operation, maintenance, error diagnosis, error correction, etc.

- The following overview lists the most common diagnostic parameters.
- Further parameters for more specific diagnostic purposes are described in the following subchapters.
- The diagnostic parameters can only be read and cannot be written to.

Parameter

Address	Name / setting range / [default setting]	Information
0x2030	CRC parameter set • Read only	Display of the 32-bit hash sum for the integrity check of the parameter set.
0x2B0B	Ramp generator frequency • Read only: x.x Hz	Display of the current frequency setpoint. The frequency setpoint is internally transferred to the motor control (based on scaling and ramp generator). The frequency setpoint is internally transferred to the motor control (based on scaling and ramp generator).
0x2B0E	Frequency setpoint • Read only: x.x Hz	Display of the frequency setpoint currently assigned. • Depending on the present operating conditions, this value may differ from the current output frequency 0x2DDD.
0x2B0F	Output frequency motor • Read only: x.x Hz	The inverter controls the motor so that the motor output frequency 0x2B0F corresponds to the frequency setpoint 0x2B0E. (Motor output frequency = output frequency of inverter - motor slip)
0x2D4F	Motor utilisation (i^2xt) • Read only: x %	Display of the current thermal motor utilisation.
0x2D87	DC-bus voltage • Read only: x V	Display of the current DC-bus voltage.
0x2D88	Motor current • Read only: x.x A	Display des present current-r.m.s. value.
0x2D89	Motor voltage • Read only: x VAC	Display of the current motor voltage.
0x2DA2:001	Output power: Effective power • Read only: x.xxx kW	Display of the active output power for an energy analysis in the respective application.
0x2DA2:002	Output power: Apparent power • Read only: x.xxx kVA	Display of the apparent output power for an energy analysis in the respective application.
0x2DA3:001	Output energy: Motor • Read only: x.xx kWh	Display of the output power in motor mode for an energy analysis in the respective application.
0x2DA3:002	Output energy: Generator • Read only: x.xx kWh	Display of the output power in generator mode for an energy analysis in the respective application.
0x2DD1:001	Motor currents: Actual D-current (id) • Read only: x.xx A	Display of the actual D current.
0x2DD1:002	Motor currents: Actual Q-current (iq) • Read only: x.xx A	Display of the actual Q current.
0x2DD1:003	Motor currents: Setpoint D-current (id) • Read only: x.xx A	Display of the setpoint D current.
0x2DD1:004	Motor currents: Setpoint Q-current (iq) • Read only: x.xx A	Display of the setpoint Q current.
0x2DD1:005	Motor currents: Motor current (Ieff) • Read only: x.xx A	Display of the effective motor current.
0x2DD3:001	Speed setpoints: Speed setpoint • Read only: x rpm	Display of the speed setpoint value 1.
0x2DD3:003	Speed setpoints: Speed setpoint limited • Read only: x rpm	Display of the limited speed setpoint.
0x2DD4:001	Speed controller output signals: Output signal 1 • Read only: x.x %	Display of the output signal 1 from the speed controller.
0x2DD4:002	Speed controller output signals: Output signal 2 • Read only: x.x %	Display of the output signal 2 from the speed controller.



Address	Name / setting range / [default setting]	Information
0x2DDC	Actual slip value • Read only: x.x Hz	Display of the actual slip.
0x2DDD	Output frequency • Read only: x.x Hz	Display of the current output frequency of the inverter.
0x2DDF:001	Axis information: Rated current • Read only: x.xx A	Display of the rated current of the axis.
0x2DDF:002	Axis information: Maximum current • Read only: x.xx A	Display of the maximum current of the axis.
0x6077	Actual torque • Read only: x.x %	Display of the actual torque. • 100 % = Rated motor torque 0x6076
0x6078	Actual current • Read only: x.x %	Display of the motor actual current. • 100 % = Rated motor current 0x6075
0x6079	DC-bus voltage • Read only: x.xxx V	Display of the current DC-bus voltage.

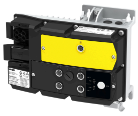
16.4.1 Inverter diagnostics

The following parameters supply some information about the current operating status of the inverter.

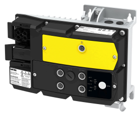
Some of the following parameters contain bit-coded status words. Each single bit has a certain meaning.

Parameter

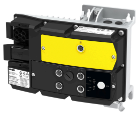
Address	Name / setting range / [default setting]	Information
0x2539:001	Hardware-Diagnose: External supply voltage • Read only: x.x V	
0x282A:001	Status words: Cause of disable • Read only	Bit-coded display of the cause(s) for disabled inverter.
	Bit 0 Flexible I/O configuration	1 = the inverter was disabled by the trigger set in 0x2631:001.
	Bit 1 Network	1 = the inverter was disabled via network.
	Bit 2 Axis command	1 = the inverter was disabled via axis command 0x2822:001.
	Bit 6 Fault DC-bus	1 = The inverter was disabled due to a DC-bus error.
	Bit 7 Drive not ready	1 = the inverter was disabled internally since the drive was not ready for operation. Possible causes: • Under/overvoltage in the DC bus • Defective device hardware
	Bit 8 Quick stop active	1 = the inverter was disabled by the "Quick stop" function.
	Bit 9 Motor data identification	1 = the inverter was disabled by the "Automatic identification of the motor data" function.
	Bit 10 Holding brake	1 = the inverter was disabled by the "Holding brake control" function.
	Bit 11 DC braking	1 = DC braking active.
	Bit 12 CiA402 Inverter disabled	1 = the inverter was disabled by the internal state machine. The bit is only set if • Operating mode 0x6060 = "CiA: Velocity mode (vl) [2]" and • state machine in the "Switch on disabled" state and • the state change has not been carried out via the "Disable operation" command.
	Bit 13 CiA402 Quick stop option code 2	1 = the inverter was disabled by the "Quick stop" function.
	Bit 14 Safety	1 = the inverter has been disabled by the integrated safety system.
	Bit 15 CiA402 operation mode 0	1 = the inverter has been disabled because the selection "No selection [0]" is set in 0x6060.



Address	Name / setting range / [default setting]		Information
0x282A:002	Status words: Cause of quick stop • Read only		Bit coded display of the cause(s) of quick stop.
	Bit 0	Flexible I/O configuration	1 = quick stop was activated by the trigger set in 0x2631:003.
	Bit 1	Network	1 = quick stop was activated via network.
	Bit 2	Axis command	1 = quick stop was activated via axis command 0x2822:003.
	Bit 6	Error response	1 = quick stop has been activated as a response to an error.
0x282A:003	Status words: Cause of stop • Read only		Bit coded display of the cause(s) of stop.
	Bit 0	Flexible I/O: Start disabled	1 = stop was activated by the trigger set in 0x2631:002.
	Bit 1	Flexible I/O: Run forward	1 = stop has been activated due to cancellation of the command "Run forward (CW)".
	Bit 2	Flexible I/O: Run reverse	1 = stop has been activated due to cancellation of the command "Run reverse (CCW)".
	Bit 3	Flexible I/O: Jog forward	1 = stop has been activated due to cancellation of the command "Jog foward (CW)".
	Bit 4	Flexible I/O: Jog reverse	1 = stop has been activated due to cancellation of the command "Jog reverse (CCW)".
	Bit 5	Network	1 = stop was activated via network.
	Bit 7	Control mode transition	1 = stop has been activated due to a change of the operating mode.
	Bit 9	Manual mode	1 = Stop was activated by the "Manual mode" function.
	Bit 15	Waiting for start	1 = stop is active as a start command is not yet available (e. g. after enabling the inverter).
0x282A:004	Status words: Extended status word • Read only		Bit-coded status word.
	Bit 8	Reverse rotational direction	1 = reversal active.
	Bit 10	Inverter disabled (safety)	1 = The safety system integrated in the inverter has disabled the inverter/drive.
	Bit 11	STO active	1 = "Safe Torque Off (STO)" safety function is active. Safe inputs SIA and SIB = LOW (simultaneously).
0x282A:005	Status words: Device status • Read only		Display of the current inverter device state.
	0	Initialisation	
	2	Not ready to switch on	
	3	Switch on disabled	
	4	Ready to switch on	
	5	Switched on	
	6	Operation enabled	
	7	Disable operation	
	8	Shut down	
	9	Quick stop active	
	10	Fault reaction active	
	11	Fault	
0x282B:001	Inverter diagnostics: Active control source • Read only		Display of the control source that is currently active.
	0	Flexible I/O configuration	
	1	Network	
	3	Internal	
	9	Manual mode	



Address	Name / setting range / [default setting]		Information
0x282B:002	Inverter diagnostics: Active setpoint source • Read only		Display of the setpoint source that is currently active.
	0	Not selected	
	4	HTL input	
	5	Network Setpoint	
	9	Manual mode: setpoint	
	11	Setpoint preset 1	
	12	Setpoint preset 2	
	13	Setpoint preset 3	
	14	Setpoint preset 4	
	15	Setpoint preset 5	
	16	Setpoint preset 6	
	17	Setpoint preset 7	
	18	Setpoint preset 8	
	19	Setpoint preset 9	
	20	Setpoint preset 10	
	21	Setpoint preset 11	
	22	Setpoint preset 12	
	23	Setpoint preset 13	
	24	Setpoint preset 14	
	25	Setpoint preset 15	
	50	Motor potentiometer	
	210	X3.1 IOL1 AI1 scaled value	Value is specified as process data object via IO-Link. • The function assignment of the connectors must be configured accordingly. • The IO-Link ports are only available on the inverter with application I/O. ▸ Configure function assignment 📖 188 ▸ Configure IO-Link ports 📖 205
	211	X3.1 IOL1 AI2 scaled value	
	212	X3.2 IOL2 AI1 scaled value	
	213	X3.2 IOL2 AI2 scaled value	
	214	X3.3 IOL3 AI1 scaled value	
	215	X3.3 IOL3 AI2 scaled value	
	216	X3.4 IOL4 AI1 scaled value	
	217	X3.4 IOL4 AI2 scaled value	
	230	Scaling1 value	Output values of the "Analog signal scaling" function. This function is used to scale internal analog signals (analog parameter values) for use within the inverter. ▸ Analog signal scaling 📖 406
	231	Scaling2 value	
0x282B:004	Inverter diagnostics: Active drive mode • Read only		Display of the active drive mode.
	0	Velocity mode	"Velocity mode" active.
	1	PID control	PID control active.
	2	Torque mode	"Torque mode" active.
	3	Test mode (internal)	Test mode active.
	4	Jog operation	"Jog foward (CW)" or "Jog reverse (CCW)" function active.

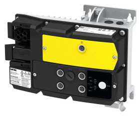


Address	Name / setting range / [default setting]	Information
0x2831	Inverter status word • Read only	Bit coded status word of the internal motor control.
	Bit 1 Speed setpoint 1 limited	1 = input of speed controller 1 in limitation.
	Bit 2 Speed controller in limitation	1 = output of speed controller 1 in limitation.
	Bit 3 Torque setpoint limited	1 = setpoint torque in limitation.
	Bit 4 Q-current setpoint limited	1 = setpoint current in limitation.
	Bit 5 Speed setpoint 2 limited	1 = input of speed controller 2 in "torque mode" in limitation.
	Bit 6 Upper speed limit active	1 = in "torque mode", the speed is limited to upper speed limit 0x2946:001 .
	Bit 7 Lower speed limit active	1 = in "torque mode", the speed is limited to lower speed limit 0x2946:002 .
	Bit 8 Flying restart active	-
	Bit 9 Flying restart completed	
	Bit 10 Output frequency limited	1 = setpoint frequency with V/f operation in limitation.
	Bit 11 Magnetization completed	1 = Magnetisation completed during V/f operation. Otherwise 0.
	Bit 12 Motor phase error	1 = motor phase failure detection active.
0x2833	Inverter status word 2 • Read only	Bit-coded status word 2 of the inverter.
	Bit 1 Manual test mode active	1 = manual test mode active.
	Bit 2 Manual control active	1 = manual control active.
	Bit 6 DC braking active	1 = DC braking active.
0x293A	Actual switching frequency • Read only	Display of the currently active switching frequency of the inverter. Example: • "16 kHz variable / drive-optimised / 4 kHz min. [22]" is selected as switching frequency in 0x2939. • An increase of the ambient temperature and/or the load have caused a decrease of the switching frequency to 8 kHz. In this case, this parameter indicates the selection "8 kHz power loss-optimized [7]".
	1 2 kHz drive-optimized	
	2 4 kHz drive-optimized	
	3 8 kHz drive-optimized	
	4 16 kHz drive-optimized	
	5 2 kHz power loss-optimized	
	6 4 kHz power loss-optimized	
	7 8 kHz power loss-optimized	
	8 16 kHz power loss-optimized	
	9 12 kHz drive-optimised	
	10 12 kHz power loss-optimised	
0x603F	Error code • Read only	Error message

16.4.2 Motor diagnostics

Parameter

Address	Name / setting range / [default setting]	Information
0x2D82	Motor actual voltage (Veff) • Read only: x.x V	Display of the current motor voltage.
0x2D83:002	Motor-Phasenströme: Phase U current • Read only: x.xx A	Display of the current of phase U.
0x2D83:003	Motor-Phasenströme: Phase V current • Read only: x.xx A	Display of the current of phase V.
0x2D83:004	Motor-Phasenströme: Phase W current • Read only: x.xx A	Display of the current of phase W.



16.4.3 Network diagnostics

The following parameters show some general information with regard to the network option available and the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x231F:001	Communication module ID: Active module ID • Read only	Display of the network options currently configured in the device. Note! When switched on, the device checks whether the parameter settings saved in the memory module match the device hardware and firmware. In case of an incompatibility, a corresponding error message is output. For details see chapter "Behaviour of the inverter in case of incompatible data in the memory module" (section "Hardware and firmware updates/downgrades"). 403
	48 No network	
	71 EtherNet/IP	
	82 PROFINET	
	84 EtherCAT	
	86 Modbus TCP/IP	
0x282B:005	Inverter diagnostics: Most recently used control register • Read only	Display of the network register for the control that was accessed last (e. g. 0x6040 or 0x400B:1). • Format: 0xiiiiss00 (iiii = hexadecimal index, ss = hexadecimal subindex) • The lowest byte is always 0x00.
0x282B:006	Inverter diagnostics: Most recently used setpoint register • Read only	Display of the network register for setpoint selection that was accessed last (e. g. 0x6042 or 0x400B:3). • Format: 0xiiiiss00 (iiii = hexadecimal index, ss = hexadecimal subindex) • The lowest byte is always 0x00.

Related topics

▶ Configuring the network 253

16.4.4 I/O diagnostics

This section describes the diagnostics of the control connections X3.x.

16.4.4.1 Digital inputs and outputs

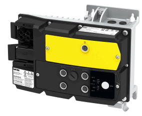
The following parameters serve to diagnose the digital inputs and outputs of the inverter.

Parameter

Address	Name / setting range / [default setting]		Information
0x60FD	Digital input status • Read only		Bit coded display of the current status of the digital inputs
	Bit 0	Reserved	-
	Bit 1		
	Bit 2		
	Bit 3		
	Bit 4		
	Bit 5		
	Bit 6		
	Bit 7		
	Bit 8		
	Bit 9		
	Bit 10		
	Bit 11		
	Bit 12		
	Bit 13		
	Bit 14		
	Bit 15		
	Bit 16	Digital input 1	0 = LOW level, 1 = HIGH level.
	Bit 17	Digital input 2	
	Bit 18	Digital input 3	
	Bit 19	Digital input 4	
	Bit 20	Digital input 5	
	Bit 21	Digital input 6	
	Bit 22	Digital input 7	
	Bit 23	Digital input 8	
	Bit 24	Reserved	-
	Bit 25	Internal interconnection of digital inputs	0 = digital inputs are internally set to HIGH (NPN) level via pull-up resistors. 1 = digital inputs are internally set to LOW (PNP) level via pull-down resistors.
	Bit 26	Reserved	-
	Bit 27		
	Bit 28		
	Bit 29		
	Bit 30		
	Bit 31		

Related topics

▸ Configure digital inputs 📖 190
▸ Configure digital outputs 📖 194



16.4.5 Service life diagnostics

The following parameters provide some information about the use of the inverter.

Parameter

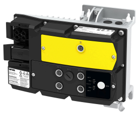
Address	Name / setting range / [default setting]	Information
0x2D81:001	Life-diagnosis: Operating time • Read only: x s	Display showing for how long the device has been running so far (device status “operation enabled”).
0x2D81:002	Life-diagnosis: Power-on time • Read only: x s	Display showing for how long the device has been supplied with line voltage so far.
0x2D81:003	Life-diagnosis: Control unit operating time • Read only: x ns	Display showing for how long the control unit has been supplied with voltage so far. This includes the external 24-V supply and voltage supply via USB module.
0x2D81:004	Life-diagnosis: Main switching cycles • Read only	Display of the number of switching cycles of the mains voltage.
0x2D81:006	Life-diagnosis: Short-circuit counter • Read only	Display of the number of short circuits that have occurred.
0x2D81:007	Life-diagnosis: Earth fault counter • Read only	Display of the number of earth faults that have occurred.
0x2D81:008	Life-diagnosis: Clamp active • Read only	Display of the number of "Clamp responded too often" errors that have occurred. • "Clamp" = short-time inhibit of the inverter in V/f operation when the current limit shown in 0x2DDF:002 is reached.
0x2D81:009	Life-diagnosis: Fan operating time • Read only: x s	Display showing for how long the internal fan has been running so far.

16.4.6 Device identification

The following parameters show some general information about the inverter.

Parameter

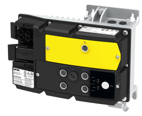
Address	Name / setting range / [default setting]	Information
0x2000:001	Device data: Product code • Read only	Product code of the complete device.
0x2000:002	Device data: Serial number • Read only	Serial number of the complete device. Example: "0000000000000000XYZXYZ"
0x2000:004	Device data: CU firmware version • Read only	Firmware version of the control unit. Example: "01.00.01.00"
0x2000:005	Device data: CU firmware type • Read only	Firmware type of the control unit. Example: "IOFW51AC10"
0x2000:006	Device data: CU bootloader version • Read only	Bootloader version of the control unit. Example: "2015.10-20180517"
0x2000:010	Device data: PU firmware version • Read only	Firmware version of the power unit. Example: "00202"
0x2000:011	Device data: PU firmware type • Read only	Firmware type of the power unit. Example: "IDFW5AA"
0x2000:012	Device data: PU bootloader version • Read only	Bootloader version of the power unit.
0x2000:013	Device data: PU bootloader type • Read only	Bootloader type of the power unit.
0x2000:015	Device data: Communication firmware revision number • Read only	Firmware version of the network option.
0x2000:018	Device data: Safety firmware type • Read only	
0x2000:021	Device data: Motor control library version • Read only	
0x2000:026	Device data: RFID firmware version • Read only	



16.5 Error handling

Many functions integrated in the inverter can

- detect errors and thus protect inverter and motor from damages,
- detect an operating error of the user,
- output a warning or information if desired.



16.5.1 Error types

In the event of an error, the inverter response is determined by the error type defined for the error.

Error type "No response"

The error is completely ignored (does not affect the running process).

Error type "Information"

The error is completely ignored (does not affect the running process). However, logging takes place in the Error history buffer/Logbook.

Error type "Warning"

A warning does not severely affect the process and may be also ignored in consideration of safety aspects.

Error type "Fault"

The motor is brought to a standstill with the quick stop ramp.

- The inverter will only be disabled after the quick stop is executed (motor at standstill) or after the time-out time set in 0x2826 has been elapsed. ▶ Timeout for error response 📖 445
- **Exception:** In case of a serious fault, the inverter is disabled immediately. The motor has no torque (coasts). For details see the table "Error codes, causes and remedies".

Error type "Trouble"

Just like "Fault", but the error state will be left automatically if the error condition is not active anymore.

- **Exception:** In case of a severe trouble, the inverter is disabled immediately. The motor has no torque (coasts). For details see the table "Error codes, causes and remedies". 📖 448
- The restart behaviour after trouble can be configured. ▶ Automatic restart after a fault 📖 399

In the operating mode 0x6060 = "CiA: Velocity mode (vl) [2]", the behaviour in case of "Trouble" is just like in case of "Fault"!

Comparison of the error types

The following table compares the main differences of the error types:

Error type	Logging in the Error history buffer / Logbook	Display CiA status word 0x6041	Inverter disable	Motor stop	Error reset is required	"ERR" LED (red)
No response	no	no	no	no	no	off
Information	yes	no	no	no	no	off
Warning	yes	yes, bit 7	no	no	no	blinking fast (4 Hz)
Trouble	yes	yes, bit 3	after quick stop or immediately.	Quick stop ramp or coasting.	no	blinking (1 Hz)
Error	yes	yes, bit 3	For details see table "Error codes, causes and remedies". 📖 448		yes	on

16.5.1.1 Timeout for error response

Parameter

Address	Name / setting range / [default setting]		Information
0x2826	Time-out for error response 0.0 ... [**6.0**] ... 10.0 s		This timer is started when a change-over to the "Fault reaction active" device status takes place. If the motor is still rotating after the time-out time has elapsed, a change-over to the "Fault" device status takes place. • In case of a serious error, an immediate change-over to the "Fault" device status takes place. ⚠ CAUTION! Changing this parameter may cause a longer ramptime in the event of an error. This must be considered when changing this parameter.

16.5.2 Error configuration

The errors can be divided into two types:

- Errors with predefined error type
- Errors with configurable error type

Especially critical errors are permanently set to the "Fault" error type in order to protect inverter and motor from damages.

In case of errors with configurable error type, the default setting can be changed in consideration of safety aspects and the operational performance. The selection "No response [0]" is, however, only available for minor errors.

The "Error codes, causes and remedies" table lists the error type for each error. If the error type can be configured by the user, the "adjustable in" column displays the corresponding parameter. 📖 448

16.5.3 Error reset

If the error condition is not active anymore, there are several options to reset an active error and thus leave the error status again:

- Via the trigger assigned to the "Reset fault" function.
- Via the button in the »EASY Starter« ("Diagnostics" tab).
- In the default setting of 0x400E:008 via bit 7 in the mappable data word NetWordIN1 0x4008:001.
- Via bit 7 in the mappable CiA control word 0x6040.
- Via bit 2 in the mappable AC Drive control word 0x400B:001.

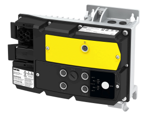
Notes:

- Certain errors can only be reset by mains switching.
- Certain errors (e.g. earth fault or short circuit of the motor phases) may cause a blocking time. In this case, the error can be reset only after the blocking time has elapsed. An active blocking time is displayed via bit 14 in the inverter status word 0x2831.

The "Error codes, causes and remedies" table gives the blocking time (if available) for each error. This table also shows whether mains switching is required for the error reset. 📖 448

Parameter

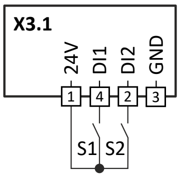
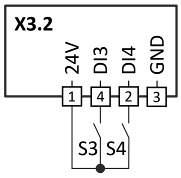
Address	Name / setting range / [default setting]		Information
0x2631:004	Function list: Reset fault • Further possible settings: ▸ Trigger list 📖 58		Assignment of a trigger for the "Reset fault" function. Trigger = FALSE↗TRUE (edge): The active error is reset (acknowledged) if the error condition no longer exists and the error is resettable. Trigger = FALSE: no action.
	12	**Digital input 2**	State of X3/DI2, taking an inversion set in 0x2632:002 into consideration.



Address	Name / setting range / [default setting]		Information
0x2839:006	Fault configuration: Fault handling in case of state change		Selection whether a pending error is to be reset via the functions "Enable inverter" 0x2631:001 and "Run" 0x2631:002 as well.
	0	**Reset fault**	
	1	Do not reset fault	

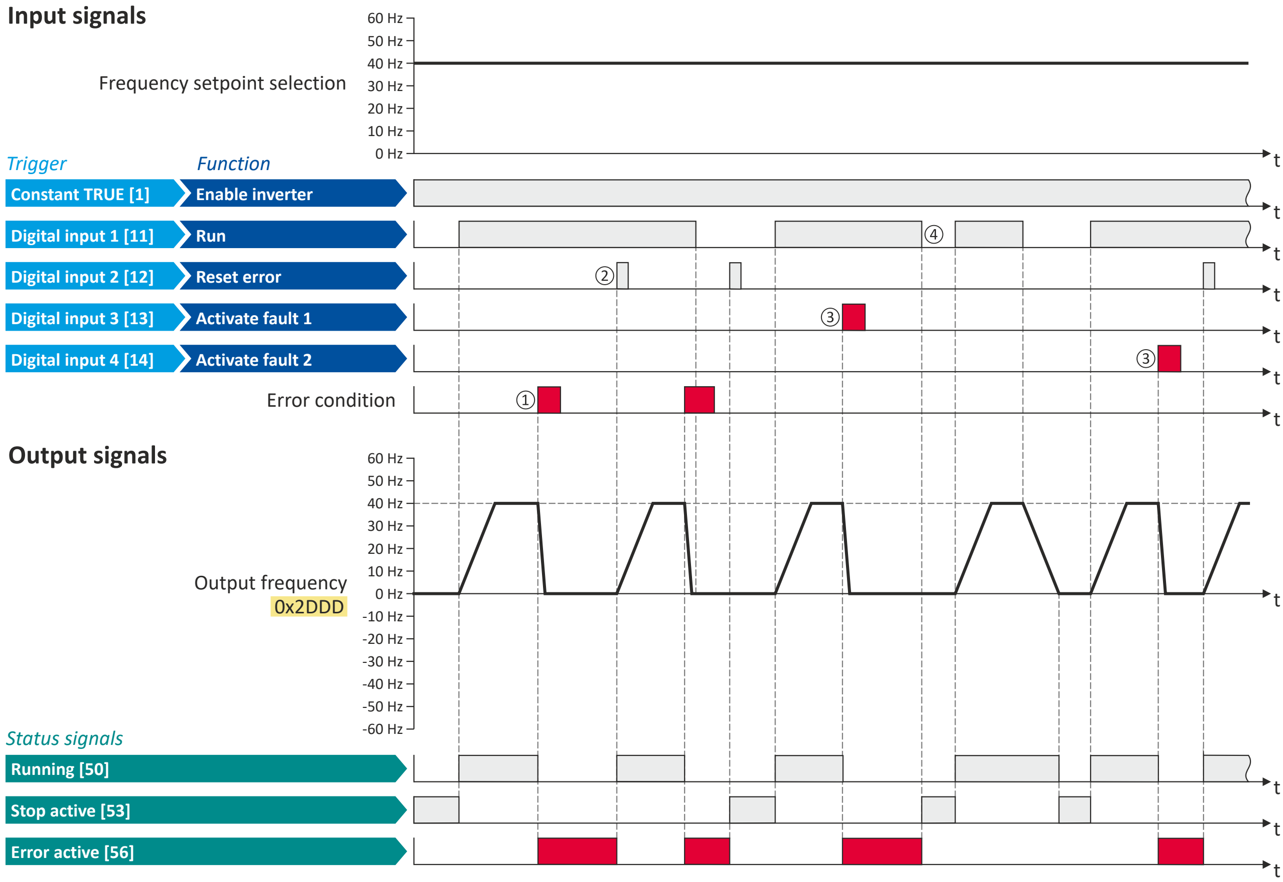
Example for operating mode

- Switch S1 starts the motor in forward direction of rotation. Switch S1 in initial position stops the motor again.
- Switch S2 resets the current error if the error condition is not active anymore and the error is resettable.
- The switches/sensors S3 and S4 serve to set the inverter from the process to the error status. ▶ User-defined error triggering 📖 400

Connection diagram		Function	
		Switch S1	Run
		Switch S2	Reverse rotational direction
		Switch S3	Activate fault 1
		Switch S4	Activate fault 2

Parameter	Name	Setting for this example
0x2630:010	Plug X3.1 configuration	DI2 + DI1 [1]
0x2630:011	Plug X3.2 configuration	DI4 + DI3 [1]
0x2631:001	Enable inverter	Constant TRUE [1]
0x2631:002	Run	Digital input 1 [11]
0x2631:004	Reset fault	Digital input 2 [12]
0x2631:013	Reverse rotational direction	Not connected [0]
0x2631:018	Activate preset (bit 0)	Not connected [0]
0x2631:043	Activate fault 1	Digital input 3 [13]
0x2631:044	Activate fault 2	Digital input 4 [14]
0x2838:003	Stop method	Standard ramp [1]
0x2860:001	Frequency control: Default setpoint source	Frequency preset 2 [12]
0x2911:002	Frequency setpoint presets: Preset 2	40.0 Hz
0x291D:002	Deceleration time 1	5.00 s
0x291C	Quick stop deceleration time	1.0 s

The following signal flow illustrates the reset of an error both with the "Reset error" function ② and by cancelling the start command ④:



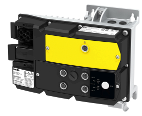
The status signals can be assigned to digital outputs. ▶ Configure digital outputs 🕮 194

① If an error condition is active in the inverter, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. Exception: In case of a serious error, the inverter is disabled immediately. The motor has no torque (coasts).

② If the error can be reset, the error status can be left again with the "Reset fault" function (if the error condition no longer exists). The motor accelerates again to the setpoint since the start command is still active.

③ The functions "Activate fault 1" and "Activate fault 2" serve to set the inverter from the process to the error status.

④ If the error can be reset, the cancelled start command results in exiting the error status (if the error condition no longer exists).



16.6 Error codes, causes and remedies

The monitoring functions of the respective network are only active when network control is activated.

▶ Activate network control 📖 255

16.6.1 Error code overview

The following table contains the most important error codes of the device in ascending order.

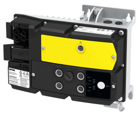
- Clicking the error code shows you a detailed description of the error message.
- If the device displays an "internal error" that is not listed here, restart the device. If the error persists, make a note of the error code and contact the manufacturer.

Error code		Error message	Error type	Configurable in
8784	0x2250	CiA: Continuous over current (internal)	Fault	-
8992	0x2320	Short circuit or earth leakage at the motor end	Fault	-
9024	0x2340	Short circuit at the motor end	Fault	-
9040	0x2350	CiA: i²xt overload (thermal state)	Fault	0x2D4B:003
9090	0x2382	Fault - Device utilization (ixt) too high	Fault	0x2D40:005
9091	0x2383	Warning - Device utilization (ixt) too high	Warning	-
9095	0x2387	Clamp responded too often	Fault	-
9096	0x2388	SL-PSM stall detection active	Trouble	-
12576	0x3120	Mains phase fault	Warning	-
12816	0x3210	Fault - DC bus overvoltage	Fault	-
12817	0x3211	DC bus overvoltage warning	Warning	-
12832	0x3220	Fault - DC bus undervoltage	Trouble	-
12833	0x3221	DC bus undervoltage warning	Warning	-
12834	0x3222	DC-bus voltage to low for power up	Warning	-
16912	0x4210	Fault - Power unit overtemperature	Fault	-
17024	0x4280	Fault - Heat sink temperature sensor	Fault	-
17025	0x4281	Heat sink fan warning	Warning	-
17029	0x4285	PU overtemperature warning	Warning	-
17168	0x4310	Motor overtemperature	Fault	0x2D49:002
20754	0x5112	External supply voltage critical	Warning	-
20864	0x5180	Overload 24 V supply	Fault	0x2630:020
24970	0x618A	Warning - Internal fan	Warning	-
25216	0x6280	Trigger/functions connected incorrectly	Trouble	-
25217	0x6281	User-defined fault 1	Fault	-
25218	0x6282	User-defined fault 2	Fault	-
25232	0x6290	Warning invert rotation	Warning	-
25233	0x6291	Maximuml allowed troubles exceeded	Fault	-
25249	0x62A1	Network: user fault 1	Fault	-
25250	0x62A2	Network: user fault 2	Fault	-
25265	0x62B1	NetWordIN1 configuration incorrect	Trouble	-
25505	0x63A1	CU: load error ID tag	Fault	-
25506	0x63A2	PU: load error ID tag	Fault	-
25507	0x63A3	Power unit unknown	Fault	-
28800	0x7080	Assertion level monitoring (Low/High)	Fault	-
28803	0x7083	HTL input fault	No response	0x2641:006
28961	0x7121	Fault - Pole position identification	Fault	-
29056	0x7180	Motor overcurrent	Fault	0x2D46:002
29445	0x7305	Encoder open circuit	Warning	0x2C45
29573	0x7385	Feedback system: speed limit	Information	-
30338	0x7682	Invalid user data	Fault	-
30345	0x7689	Memory module: invalid OEM data	Warning	-
30347	0x768B	OEM data are missing	Fault	-

Error code		Error message	Error type	Configurable in
30352	0x7690	EPM firmware version incompatible	Fault	-
30357	0x7695	Invalid parameter changeover configuration	Warning	-
33042	0x8112	Network - Time-out explicit message	Warning	0x2859:006
33044	0x8114	Network - Overall communication time-out	Warning	0x2859:007
33046	0x8116	Modbus TCP master time-out	Fault	0x2859:008
33047	0x8117	Modbus TCP Keep Alive time-out	Fault	0x2859:009
33168	0x8190	Network - Watchdog time-out	Trouble	0x2859:001
33169	0x8191	Network - Disruption of cyclic data exchange	Fault	-
33170	0x8192	Network - Initialization error	Trouble	0x2859:004
33171	0x8193	Network - Invalid cyclic process data	Trouble	0x2859:005
33217	0x81C1	IO-Link port 1 error	No response	0x24A1:047
33218	0x81C2	IO-Link port 2 error	No response	0x24A2:047
33219	0x81C3	IO-Link port 3 error	No response	0x24A3:047
33220	0x81C4	IO-Link port 4 error	No response	0x24A4:047
33221	0x81C5	IO-Link port 1 warning	No response	0x24A1:048
33222	0x81C6	IO-Link port 2 warning	No response	0x24A2:048
33223	0x81C7	IO-Link port 3 warning	No response	0x24A3:048
33224	0x81C8	IO-Link port 4 warning	No response	0x24A4:048
33414	0x8286	Network - PDO mapping error	Trouble	0x2859:003
33553	0x8311	Torque limit reached	No response	0x2D67:001
33664	0x8380	Function not allowed in selected operating mode	Warning	-
65282	0xFF02	Fault - Motor holding brake	Fault	-
65286	0xFF06	Motor overspeed	Fault	0x2D44:002
65289	0xFF09	Motor phase missing	No response	0x2D45:001
65290	0xFF0A	Motor phase failure phase U	No response	0x2D45:001
65291	0xFF0B	Motor phase failure phase V	No response	0x2D45:001
65292	0xFF0C	Motor phase failure phase W	No response	0x2D45:001
65305	0xFF19	Motor parameter identification fault	Fault	-
65335	0xFF37	Automatic start disabled	Fault	-
65336	0xFF38	Load loss detected	No response	0x4006:003
65337	0xFF39	Motor overload	No response	0x4007:003
65366	0xFF56	Maximum motor frequency reached	Warning	-
65370	0xFF5A	Manual mode disabled	Warning	-
65371	0xFF5B	Manual mode activated	Warning	-
65372	0xFF5C	Manual mode time-out	Fault	-
65373	0xFF5D	Safety option - Internal error	Fault	-

8784 | 0x2250 **CiA: Continuous over current (internal)**

Cause	Remedy	Error type/response
• Continuous overcurrent on the inverter/ motor side. • DC bus relay has not been closed due to a malfunction.	• Check motor and wiring for short circuits.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting). • The error can only be reset after a blocking time.
		Blocking time: 5 s



8992 | 0x2320 **Short circuit or earth leakage at the motor end**

Cause	Remedy	Error type/response
• Short circuit/earth fault of motor cable • Capacitive charging current of the motor cable too high.	• Check motor cable. • Check length of the motor cable. • Use shorter or lower-capacitance motor cable.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting). • The error can only be reset after a blocking time.
		Blocking time: 5 s

9024 | 0x2340 **Short circuit at the motor end**

Cause	Remedy	Error type/response
Short circuit of motor cable	Check motor cable for short circuit.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting). • The error can only be reset after a blocking time.
		Blocking time: 5 s

9040 | 0x2350 **CiA: i²xt overload (thermal state)**

Cause	Remedy	Error type/response
Motor thermally overloaded, e. g. by an impermissible continuous current or by frequent or too long acceleration processes.	• Check drive sizing. • Check machine/driven mechanics for excessive load. • Check settings of the motor data. • Reduce values for slip compensation 0x2B09:001, 0x2B09:002 and oscillation damping 0x2B0A:001, 0x2B0A:002.	Fault (configurable) • The error can only be reset after a blocking time.
		Blocking time: 5 s
		Setting parameters: 0x2D4B:003

Related topics
- Motor overload monitoring (i²xt) 176

9090 | 0x2382 **Fault - Device utilization (ixt) too high**

Cause	Remedy	Error type/response
Device utilisation (ixt) too high by frequent and too long acceleration processes.	Check drive sizing. • Reduce the maximum current of the inverter 0x6073. • In case of high mass inertias, reduce maximum current of the inverter 0x6073 to 150 %.	Fault (configurable) • The error can only be reset after a blocking time.
		Blocking time: 3 s
		Setting parameters: 0x2D40:005

Related topics
- Device overload monitoring (ixt) 397

9091 | 0x2383 **Warning - Device utilization (ixt) too high**

Cause	Remedy	Error type/response
Device utilisation (ixt) too high by frequent and too long acceleration processes.	Check drive dimensioning.	Warning

Related topics
- Device overload monitoring (ixt) 397

9095 | 0x2387 **Clamp responded too often**

Cause	Remedy	Error type/response
Maximum current of the axis (display in 0x2DDF:002) has been reached too often in succession.	• Select a flatter speed ramp. • Reduce the load. • Set Imax controller more dynamically.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting).

Related topics
▸ Imax controller 🕮 172

9096 | 0x2388 **SL-PSM stall detection active**

Cause	Remedy	Error type/response
Overload of the motor with sensorless control for synchronous motors (SL-PSM).	• Reduce load at the axis. • Check settings of the SL-PSM parameters.	Trouble • The inverter is disabled immediately. The motor has no torque (is coasting).

Related topics
▸ Sensorless control for synchronous motor (SLSM-PSM) 🕮 139

12576 | 0x3120 **Mains phase fault**

Cause	Remedy	Error type/response
Mains phase failure	• Check wiring of the mains connection. • Check fuses.	Warning

12816 | 0x3210 **Fault - DC bus overvoltage**

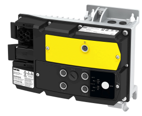
Cause	Remedy	Error type/response
DC-bus voltage has exceeded the error threshold for overvoltage due to a too high braking energy or a too high mains voltage. The error threshold (display in 0x2540:006) results from the setting of the rated mains voltage in 0x2540:001.	• Reduce dynamic performance of the load profile. • Check mains voltage. • Check settings for brake energy management.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting).

Related topics
▸ Mains voltage 🕮 36

12817 | 0x3211 **DC bus overvoltage warning**

Cause	Remedy	Error type/response
DC-bus voltage has exceeded the warning threshold for overvoltage set in 0x2540:005 due to a too high braking energy or a too high mains voltage.	• Reduce dynamic performance of the load profile. • Check mains voltage. • Check settings for brake energy management.	Warning

Related topics
▸ Mains voltage 🕮 36



12832 | 0x3220 **Fault - DC bus undervoltage**

Cause	Remedy	Error type/response
DC-bus voltage has fallen below the error threshold for undervoltage. The error threshold (display in 0x2540:003) results from the setting of the rated mains voltage in 0x2540:001.	• Check mains voltage. • 0x2D87Check DC-bus voltage. • Check mains settings. • Check fuses.	Trouble

Related topics
▸ Mains voltage 📖 36

12833 | 0x3221 **DC bus undervoltage warning**

Cause	Remedy	Error type/response
DC-bus voltage has fallen below the warning threshold for undervoltage set in 0x2540:002.	• Check mains voltage. • 0x2D87 Check DC-bus voltage. • Check mains settings. • Check fuses.	Warning

Related topics
▸ Mains voltage 📖 36

12834 | 0x3222 **DC-bus voltage to low for power up**

Cause	Remedy	Error type/response
The input voltage is too low to switch on the inverter.	• Check mains voltage. • Check mains settings. • Check fuses.	Warning

Related topics
▸ Mains voltage 📖 36

16912 | 0x4210 **Fault - Power unit overtemperature**

Cause	Remedy	Error type/response
The heatsink temperature of the power unit (display in 0x2D84:001) has exceeded the fixed error threshold (100 °C). • Ambient temperature too high. • Fan or ventilation slots are polluted. • Fan is defective.	• Check mains voltage. • Provide for a sufficient cooling of the device. In case of a 100 % load, 60 C to +70°C are normal. Display of the heatsink temperature in 0x2D84:001. • Clean fan and ventilation slots. If required, replace fan. • Reduce switching frequency 0x2939	Fault

17024 | 0x4280 **Fault - Heat sink temperature sensor**

Cause	Remedy	Error type/response
Sensor for the temperature monitoring of the power unit is defective. The failure of the temperature monitoring function poses the risk of overheating!	Hardware error: it is necessary to contact the manufacturer, since the device must be replaced.	Fault

17025 | 0x4281 **Heat sink fan warning**

Cause	Remedy	Error type/response
Warning of the heatsink fan.	Clean fan and ventilation slots. If required, replace fan. The fans can be unlocked via locking hooks and can then be removed.	Warning

17029 | 0x4285 **PU overtemperature warning**

Cause	Remedy	Error type/response
The heatsink temperature of the power unit (display in 0x2D84:001) has exceeded the warning threshold set in 0x2D84:002. • Ambient temperature too high. • Fan or ventilation slots are polluted. • Fan is defective.	• Provide for a sufficient cooling of the device. • Clean fan and ventilation slots. • If required, replace fan.	Warning

Related topics

▸ Heatsink temperature monitoring 📖 398

17168 | 0x4310 **Motor overtemperature**

Cause	Remedy	Error type/response
The PTC or thermal contact connected to the motor connector/terminal X105 or terminal 109 measures a too high motor temperature. • Motor too hot by impermissibly high currents. • Motor too hot by frequent and too long acceleration processes.	• Check drive sizing. • Check PTC/thermal contact and wiring. • If no PTC or thermal contact is connected to T1 and T2, deactivate motor temperature monitoring: 0x2D49:002 = 0	Fault (configurable) • The error can only be reset after a blocking time. Blocking time: 5 s Setting parameters: 0x2D49:002

Related topics

▸ Motor temperature monitoring 📖 180

20754 | 0x5112 **External supply voltage critical**

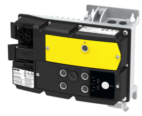
Cause	Remedy	Error type/response
External supply voltage failed or too low.	• Check optional auxiliary supply on X100.1/24E.1, if connected. • Check mains voltage.	Warning

20864 | 0x5180 **Overload 24 V supply**

Cause	Remedy	Error type/response
Output current at the 24V output or at the digital outputs too high.	Check 24V output and digital outputs for earth fault or overload.	Fault (configurable) Setting parameters: 0x2630:020

24970 | 0x618A **Warning - Internal fan**

Cause	Remedy	Error type/response
Warning of the internal fan.	Check/replace internal fan.	Warning



25216 | 0x6280 **Trigger/functions connected incorrectly**

Cause	Remedy	Error type/response
The assignment directives have not been observed. • If the "flexible I/O configuration" is active as control source, the "Enable inverter" or "Run" function must be connected to a digital input in order that the motor can be stopped again any time! • The use of the "Start forward (CW)" and "Start reverse (CCW)" functions excludes the use of the "Run forward (CW)" and "Run reverse (CCW)" functions, and vice versa.	Check and correct the assignment of the triggers to the functions. • With network control, the two "Enable inverter 0x2631:001" and "Run 0x2631:002" functions can also be set to "Constant TRUE [1]" to start the motor.	Trouble

Related topics
▸ Start, stop and rotating direction commands 📖 51

25217 | 0x6281 **User-defined fault 1**

Cause	Remedy	Error type/response
Flexible I/O configuration: the "Activate fault 1" function was activated via the trigger selected in 0x2631:043.	Eliminate error cause and then reset error.	Fault

Related topics
▸ User-defined error triggering 📖 400

25218 | 0x6282 **User-defined fault 2**

Cause	Remedy	Error type/response
Flexible I/O configuration: the "Activate fault 2" function was activated via the trigger selected in 0x2631:044.	Eliminate error cause and then reset error.	Fault

Related topics
▸ User-defined error triggering 📖 400

25232 | 0x6290 **Warning invert rotation**

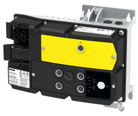
Cause	Remedy	Error type/response
• Negative setpoint selection with an active limitation of rotation 0x283A. • The "Reverse rotational direction" 0x2631:013 function was requested with an active limitation of rotation 0x283A.	• Check setpoint selection and trigger. • Check setting in 0x283A.	Warning • The motor is brought to a standstill, since a reversal of the rotating direction is not permissible.

Related topics
▸ Control/restrict direction of rotation of the motor 📖 70

25233 | 0x6291 **Maximuml allowed troubles exceeded**

Cause	Remedy	Error type/response
The number of permitted restart attempts after a fault set in 0x2839:003 was exceeded. The fault occurred to frequently and could not be reset.	Check and the eliminate the fault.	Fault • The motor remains at a standstill, no automatic restart is executed.

Related topics
▸ Automatic restart after a fault 📖 399



25249 | 0x62A1 **Network: user fault 1**

Cause	Remedy	Error type/response
The "Activate fault 1" function was triggered via the NetWordIN1 data word 0x4008:001.	Eliminate error cause and then reset error.	Fault

Related topics
▸ Define your own control word format 📖 258

25250 | 0x62A2 **Network: user fault 2**

Cause	Remedy	Error type/response
The "Activate fault 2" function was triggered via the NetWordIN1 data word 0x4008:001.	Eliminate error cause and then reset error.	Fault

Related topics
▸ Define your own control word format 📖 258

25265 | 0x62B1 **NetWordIN1 configuration incorrect**

Cause	Remedy	Error type/response
Two bits of the NetWordIN1 data word 0x4008:001 were assigned to the same function.	Check and correct configuration of the NetWordIN1 data word. • The functions that are to be triggered via bits 0 ... 15 of the NetWordIN1 data word are defined in 0x400E:001 ... 0x400E:016.	Trouble

Related topics
▸ Define your own control word format 📖 258

25505 | 0x63A1 **CU: load error ID tag**

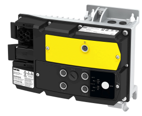
Cause	Remedy	Error type/response
Calibration data of the control unit not compatible or faulty.	• Update firmware of the inverter to the most recent version. • If the error persists, the control unit or the device has to be replaced. In this case, please contact the manufacturer.	Fault

25506 | 0x63A2 **PU: load error ID tag**

Cause	Remedy	Error type/response
Calibration data of the power unit not compatible or faulty.	• Update firmware of the inverter to the most recent version. • If the error persists, the power unit or the device has to be replaced. In this case, please contact the manufacturer.	Fault

25507 | 0x63A3 **Power unit unknown**

Cause	Remedy	Error type/response
The power unit installed is not supported by the software.	Update firmware of the inverter to the most recent version.	Fault



28800 | 0x7080 **Assertion level monitoring (Low/High)**

Cause	Remedy	Error type/response
The last setting of the connection level differs from the saved setting.	1. Execute device command "Save user data" 0x2022:003. 2. Switch inverter off and on again.	Fault

28803 | 0x7083 **HTL input fault**

Cause	Remedy	Error type/response
		No response (configurable)
		Setting parameters: 0x2641:006

28961 | 0x7121 **Fault - Pole position identification**

Cause	Remedy	Error type/response
• Too many deviations during the pole position identification. • Compared to the inverter, the rated motor current is too high or too low.	• Check setting of the motor data. • Ensure that the motor is at a standstill during the pole position identification process. • Ensure that the motor and inverter match each other in terms of power.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting).

29056 | 0x7180 **Motor overcurrent**

Cause	Remedy	Error type/response
The motor current has exceeded the warning/ error threshold for the motor current monitoring set in 0x2D46:001.	• Check motor load. • Check drive dimensioning. • Check warning threshold or error threshold set in 0x2D46:001.	Fault (configurable) • The error can only be reset after a blocking time.
		Blocking time: 1 s
		Setting parameters: 0x2D46:002

Related topics
▸ Overcurrent monitoring 📖 181

29445 | 0x7305 **Encoder open circuit**

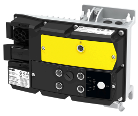
Cause	Remedy	Error type/response
The encoder signal loss monitoring function has detected a failure of the encoder signal.	• Check the encoder connection. • Check encoder cable for wire breakage. • Check encoder current supply.	Warning (configurable)
		Setting parameters: 0x2C45

Related topics
▸ Configure encoder input 📖 110

29573 | 0x7385 **Feedback system: speed limit**

Cause	Remedy	Error type/response
The feedback system exceeds the maximum permissible frequency range of the digital inputs.	Check feedback system.	Information

Related topics
▸ Configure encoder input 📖 110



30338 | 0x7682 **Invalid user data**

Cause	Remedy	Error type/response
The user parameter settings in the memory module are invalid.	1. Execute user parameter settings again. 2. Execute device command "Save user data" 0x2022:003.	Fault • The user parameter settings are lost. • The default settings were automatically loaded.

30345 | 0x7689 **Memory module: invalid OEM data**

Cause	Remedy	Error type/response
The OEM memory contains invalid parameter settings or is empty.	• Execute device command "Save OEM data" 0x2022:006. • Thus, the user parameter settings get lost!	Warning • The user parameter settings were automatically loaded.

30347 | 0x768B **OEM data are missing**

Cause	Remedy	Error type/response
There are no parameter settings preconfigured by the OEM/machine builder in the OEM memory.	Execute the "Save OEM data" (0x2022:006) device command to save the current parameter settings in the OEM memory in a power-failure-proof manner.	Fault

Related topics

▸ Saving/loading the parameter settings 📖 390

30352 | 0x7690 **EPM firmware version incompatible**

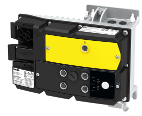
Cause	Remedy	Error type/response
The parameter settings saved in the memory module are incompatible with the firmware version.	1. Execute device command "Load default settings" 0x2022:001. 2. Execute "Save user data" 0x2022:003 or "Save OEM data" 0x2022:006 device command.	Fault • The data have been loaded into the RAM memory, but they are incompatible.

30357 | 0x7695 **Invalid parameter changeover configuration**

Cause	Remedy	Error type/response
One or more parameters can no longer be used for the "Parameter change-over" function.	1. Check error message for parameter change-over in 0x4047:001. 2. Correct the list entry shown in 0x4047:002.	Warning • The parameter change-over function is deactivated.

33042 | 0x8112 **Network - Time-out explicit message**

Cause	Remedy	Error type/response
• Within the time-out period for explicit messages, which has been parameterised by the scanner, no "explicit message" was received. • The connection to the scanner has been interrupted. • Failure of an explicit connection.	• Check cables and terminals. • Plug network cables into the Ethernet port. • Check the requested package interval (RPI) of the explicit connection. • Increase time limit for explicit messages in the scanner.	Warning (configurable) Setting parameters: 0x2859:006



33044 | 0x8114 **Network - Overall communication time-out**

Cause	Remedy	Error type/response
• EtherNet/IP: the maximum permissible time-out period for the CIP communication set in 0x23A1:010 has been exceeded. • Modbus TCP/IP: the maximum permissible time-out period for the TCP communication set in 0x23B1:010 has been exceeded.	• Check cables and terminals. • Connect network cable.	Warning (configurable) Setting parameters: 0x2859:007

33046 | 0x8116 **Modbus TCP master time-out**

Cause	Remedy	Error type/response
No valid messages have been received by the Modbus master for a time longer than the time-out period set in 0x23B6:001.	Check communication with the master.	Fault (configurable) Setting parameters: 0x2859:008

Related topics
▸ Monitoring 369

33047 | 0x8117 **Modbus TCP Keep Alive time-out**

Cause	Remedy	Error type/response
For a time longer than the time-out period set in 0x23B6:002, no value was entered into the Keep alive register 0x23B6:005.	Check communication with the master.	Fault (configurable) Setting parameters: 0x2859:009

Related topics
▸ Monitoring 369

33168 | 0x8190 **Network - Watchdog time-out**

Cause	Remedy	Error type/response
Time-out during cyclic data reception, e.g. due to an interrupted communication link to the master or missing cyclic data.	• Check wiring of the network. • Eliminate EMC interferences.	Trouble (configurable) Setting parameters: 0x2859:001

33169 | 0x8191 **Network - Disruption of cyclic data exchange**

Cause	Remedy	Error type/response
The communication partner has interrupted the cyclic data exchange.	• Check wiring of the network. • The slave must receive new parameterisation and configuration files by the master, in order to be able to exchange data again.	Fault

33170 | 0x8192 **Network - Initialization error**

Cause	Remedy	Error type/response
The initialisation of the communication stack has been interrupted due to an incorrect address setting or communication configuration.	Check master/slave configuration and restart the devices.	Trouble (configurable) Setting parameters: 0x2859:004

33171 | 0x8193 **Network - Invalid cyclic process data**

Cause	Remedy	Error type/response
The cyclic process data received are invalid.	Check cyclic process data sent by the master.	Trouble (configurable) Setting parameters: 0x2859:005

33217 | 0x81C1 **IO-Link port 1 error**

Cause	Remedy	Error type/response
An event of the type "Error" has occurred at IO-Link port 1.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A1:047

Related topics
▶ Configure IO-Link ports 🕮 205

33218 | 0x81C2 **IO-Link port 2 error**

Cause	Remedy	Error type/response
An event of the type "Error" has occurred at IO-Link port 2.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A2:047

Related topics
▶ Configure IO-Link ports 🕮 205

33219 | 0x81C3 **IO-Link port 3 error**

Cause	Remedy	Error type/response
An event of the type "Error" has occurred at IO-Link port 3.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A3:047

Related topics
▶ Configure IO-Link ports 🕮 205

33220 | 0x81C4 **IO-Link port 4 error**

Cause	Remedy	Error type/response
An event of the type "Error" has occurred at IO-Link port 4.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A4:047

Related topics
▶ Configure IO-Link ports 🕮 205

33221 | 0x81C5 **IO-Link port 1 warning**

Cause	Remedy	Error type/response
An event of the type “Warning" has occurred at IO-Link port 1.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A1:048

Related topics
▶ Configure IO-Link ports 🕮 205

33222 | 0x81C6 **IO-Link port 2 warning**

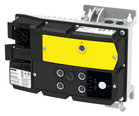
Cause	Remedy	Error type/response
An event of the type “Warning" has occurred at IO-Link port 2.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A2:048

Related topics
▶ Configure IO-Link ports 🕮 205

33223 | 0x81C7 **IO-Link port 3 warning**

Cause	Remedy	Error type/response
An event of the type “Warning" has occurred at IO-Link port 3.	• Check connected IO-Link device.	No response (configurable)
	• Check configuration of the IO-Link port.	Setting parameters: 0x24A3:048

Related topics
▶ Configure IO-Link ports 🕮 205



33224 | 0x81C8 **IO-Link port 4 warning**

Cause	Remedy	Error type/response
An event of the type “Warning" has occurred at IO-Link port 4.	• Check connected IO-Link device. • Check configuration of the IO-Link port.	No response (configurable) Setting parameters: 0x24A4:048

Related topics

▸ Configure IO-Link ports 📖 205

33414 | 0x8286 **Network - PDO mapping error**

Cause	Remedy	Error type/response
• Invalid PDO assignment by the master. • Internal PDO assignment was changed and does not comply with the configuration available in the master.	Check data mapping in the master and slave.	Trouble (configurable) Setting parameters: 0x2859:003

33553 | 0x8311 **Torque limit reached**

Cause	Remedy	Error type/response
Motor has reached the torque limit: • 0x2949:003: Actual positive torque limit • 0x2949:004: Actual negative torque limit	• Observe load requirements. • Reduce motor load. • Check set torque limits and sources for the torque limits.	No response (configurable) Setting parameters: 0x2D67:001

Related topics

▸ Motor torque monitoring 📖 184

33664 | 0x8380 **Function not allowed in selected operating mode**

Cause	Remedy	Error type/response
The selected function is not permissible in the chosen operating mode. • Selection of torque mode [-1] in 0x6060 with incompatible motor control in 0x2C00. • Selection of invalid drive mode [0] in 0x6060.	• Note: selection of torque mode [-1] in 0x6060 with incompatible motor control in 0x2C00. • Check settings of operation modes. • 0x6060	Warning

65282 | 0xFF02 **Fault - Motor holding brake**

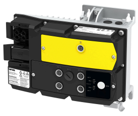
Cause	Remedy	Error type/response
Brake fault due to short circuit or cable break.	Check brake. Check wiring.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting).

65286 | 0xFF06 **Motor overspeed**

Cause	Remedy	Error type/response
The motor speed has reached the error threshold for overspeed set in 0x2D44:001.	Adapt the maximum motor speed 0x6080 and the warning threshold or error threshold 0x2D44:001.	Fault (configurable) • The error can only be reset after a blocking time. Blocking time: 1 s Setting parameters: 0x2D44:002

Related topics

▸ Motor speed monitoring 📖 182



65289 | 0xFF09 **Motor phase missing**

Cause	Remedy	Error type/response
A failure of several motor phases has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection.	No response (configurable) • The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001

Related topics
▶ Motor phase failure detection 🕮 182

65290 | 0xFF0A **Motor phase failure phase U**

Cause	Remedy	Error type/response
A failure of the motor phase U has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection. - 0x2D45:002 (Current threshold) - 0x2D45:003 (Voltage threshold)	No response (configurable) • The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001

Related topics
▶ Motor phase failure detection 🕮 182

65291 | 0xFF0B **Motor phase failure phase V**

Cause	Remedy	Error type/response
A failure of the motor phase V has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection. - 0x2D45:002 (Current threshold) - 0x2D45:003 (Voltage threshold)	No response (configurable) • The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001

Related topics
▶ Motor phase failure detection 🕮 182

65292 | 0xFF0C **Motor phase failure phase W**

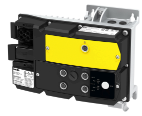
Cause	Remedy	Error type/response
		No response (configurable) • The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001

65305 | 0xFF19 **Motor parameter identification fault**

Cause	Remedy	Error type/response
During the automatic identification of the motor, an error has occurred.	• Set motor data so that they comply with the data on the motor nameplate. • Check wiring of the motor.	Fault

65335 | 0xFF37 **Automatic start disabled**

Cause	Remedy	Error type/response
At mains connection, a start command was already available and the automatic start at power-up is set in 0x2838:002 to "Off [0]".	Deactivate starting command and reset error.	Fault



65336 | 0xFF38 **Load loss detected**

Cause	Remedy	Error type/response
In a running motor, the motor load (current) is monitored. When the motor load falls below the threshold value specified in Load loss detection: threshold (0x4006:001) for the period of time specified in Load loss detection: delay time (0x4006:002), load loss protection is triggered.	Check utilisation	No response (configurable) Setting parameters: 0x4006:003

65337 | 0xFF39 **Motor overload**

Cause	Remedy	Error type/response
If the apparent motor current exceeds a defined threshold value 0x4007:002 for a certain amount of time 0x4007:001, heavy duty monitoring is triggered.	Check the motor load.	No response (configurable) Setting parameters: 0x4007:003

65366 | 0xFF56 **Maximum motor frequency reached**

Cause	Remedy	Error type/response
• The limitation of the maximum motor speed set in 0x6080 is active. • The maximum output frequency of the inverter has been reached. • Depending on the parameter setting of 0x2D44:001 (Overspeed monitoring: threshold), the speed limitation (0x6080 / Max. motor speed) may become active before speed monitoring.	Check application.	Warning

65370 | 0xFF5A **Manual mode disabled**

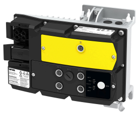
Cause	Remedy	Error type/response
Indicates the deactivation of the manual speed control.		Warning

65371 | 0xFF5B **Manual mode activated**

Cause	Remedy	Error type/response
Indicates the activation of the manual speed control.		Warning

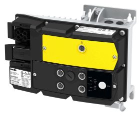
65372 | 0xFF5C **Manual mode time-out**

Cause	Remedy	Error type/response
If "manual operation" is active, an error is generated in case the communication links get lost.	The error can be only be reset if the connection is restored or the control mode is changed to a different value than "manual operation".	Fault • The inverter is disabled immediately. The motor has no torque (is coasting).



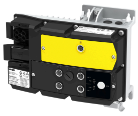
65373 | 0xFF5D **Safety option - Internal error**

Cause	Remedy	Error type/response
The integrated safety technology is defective.	The inverter must be replaced. Note! The user is not allowed to change inverters that come with integrated safety technology. • The safety module must not be removed. • The user must not carry out any repairs on the safety module. • The safety module is not a spare part.	Fault • The inverter is disabled immediately. The motor has no torque (is coasting).



17 Technical data

The technical data for the device (dimensions, rated data, standards and operating conditions) can be found in the associated project planning document.



18 Appendix

18.1 Parameter attribute list

The parameter attribute list in particular contains some information required for reading and writing parameters via network.

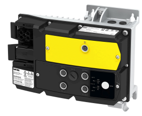
The following conventions are used in this documentation for specifying the parameter address:

- The index is specified as a hexadecimal value.
- The subindex is specified as a decimal value.

- The parameter attribute list contains all parameters of the inverter.
- The parameter attribute list is sorted by addresses (index:subindex) in ascending order.

How to read the parameter attribute list:

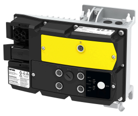
Column	Meaning	
Address	Address of the parameter in the object directory. Format: index:subindex	
Name	Parameter name	
Default setting	Default setting of the parameter	
Category	Functional assignment of the parameter, for example "general", "EtherNet/IP" or "MCTRL" (Motor control).	
Data type	Data type of the parameter:	
	I8	1 byte, with sign
	I16	2 bytes with sign
	I32	4 bytes with sign
	I64	8 bytes with sign
	U8	1 byte without sign
	U16	2 bytes without sign
	U32	4 bytes without sign
	U64	8 bytes without sign
	REAL32	4 bytes floating point
	STRING[xx]	ASCII string (with character length xx)
	OCTET[xx]	OCTET string (with xx bytes)
	IDX	4 bytes without sign. Is used specially for addressing parameters.
Factor	Factor for data transmission via network, depending on the number of decimal positions:	
	1	No decimal positions
	10	1 decimal position
	100	2 decimal positions
	1000	3 decimal positions
	10000	4 decimal positions
A	Attributes (combinations of several attributes also possible):	
	C	Setting can only be changed if the inverter is inhibited.
	E	Value is displayed as IP address in the engineering tool.
	H	Value is displayed as hexadecimal value in the engineering tool.
	I	Parameter is not displayed.
	K	Parameter is read-only with the keypad.
	O	Parameter can be recorded with the oscilloscope function.
	P	Setting is saved in the memory module.
	X	Parameter is not displayed in the engineering tools.
M	Mapping:	
	r	Receive mapping permissible.
	t	Transmit mapping permissible.
	rt	Receive and transmit mapping permissible.
	-	Mapping not permissible.



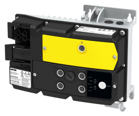
Parameter attribute list (short overview of all parameter indexes)

Address	Name	Default setting	Category	Data type	Factor	A	M
0x2000:001	Device data: Product code	- (Read only)	general	STRING[18]		-	-
0x2000:002	Device data: Serial number	- (Read only)	general	STRING[50]		-	-
0x2000:004	Device data: CU firmware version	- (Read only)	general	STRING[50]		-	-
0x2000:005	Device data: CU firmware type	- (Read only)	general	STRING[50]		-	-
0x2000:006	Device data: CU bootloader version	- (Read only)	general	STRING[50]		-	-
0x2000:010	Device data: PU firmware version	- (Read only)	general	STRING[12]		-	-
0x2000:011	Device data: PU firmware type	- (Read only)	general	STRING[12]		-	-
0x2000:012	Device data: PU bootloader version	- (Read only)	general	STRING[12]		-	-
0x2000:013	Device data: PU bootloader type	- (Read only)	general	STRING[12]		-	-
0x2000:015	Device data: Communication firmware revision number	- (Read only)	Network	STRING[50]		-	-
0x2000:018	Device data: Safety firmware type	- (Read only)	general	STRING[12]		-	-
0x2000:021	Device data: Motor control library version	- (Read only)	MCTRL	STRING[11]		-	-
0x2000:026	Device data: RFID firmware version	- (Read only)	general	STRING[11]		-	-
0x2001	Device name	**"My Device"**	general	STRING[128]		PK	-
0x2006:000	Error history buffer: Keypad display	- (Read only)	general	U8	1	-	-
0x2006:001	Error history buffer: Maximum number of messages	- (Read only)	general	U8	1	-	-
0x2006:002	Error history buffer: Latest message	- (Read only)	general	U8	1	-	-
0x2006:003	Error history buffer: Latest acknowledgement message	**0**	general	U8	1	-	-
0x2006:004	Error history buffer: New message	- (Read only)	general	U8	1	-	t
0x2006:005	Error history buffer: Configuration/Status	**1**	general	U16	1	-	-
0x2006:006	Error history buffer: Message 0	- (Read only)	general	OCTET[19]		-	-
0x2006:007	Error history buffer: Message 1	- (Read only)	general	OCTET[19]		-	-
0x2006:008	Error history buffer: Message 2	- (Read only)	general	OCTET[19]		-	-
0x2006:009	Error history buffer: Message 3	- (Read only)	general	OCTET[19]		-	-
0x2006:010	Error history buffer: Message 4	- (Read only)	general	OCTET[19]		-	-
0x2006:011	Error history buffer: Message 5	- (Read only)	general	OCTET[19]		-	-
0x2006:012	Error history buffer: Message 6	- (Read only)	general	OCTET[19]		-	-
0x2006:013	Error history buffer: Message 7	- (Read only)	general	OCTET[19]		-	-
0x2006:014	Error history buffer: Message 8	- (Read only)	general	OCTET[19]		-	-
0x2006:015	Error history buffer: Message 9	- (Read only)	general	OCTET[19]		-	-
0x2006:016	Error history buffer: Message 10	- (Read only)	general	OCTET[19]		-	-
0x2006:017	Error history buffer: Message 11	- (Read only)	general	OCTET[19]		-	-
0x2006:018	Error history buffer: Message 12	- (Read only)	general	OCTET[19]		-	-
0x2006:019	Error history buffer: Message 13	- (Read only)	general	OCTET[19]		-	-
0x2006:020	Error history buffer: Message 14	- (Read only)	general	OCTET[19]		-	-
0x2006:021	Error history buffer: Message 15	- (Read only)	general	OCTET[19]		-	-
0x2006:022	Error history buffer: Message 16	- (Read only)	general	OCTET[19]		-	-
0x2006:023	Error history buffer: Message 17	- (Read only)	general	OCTET[19]		-	-
0x2006:024	Error history buffer: Message 18	- (Read only)	general	OCTET[19]		-	-
0x2006:025	Error history buffer: Message 19	- (Read only)	general	OCTET[19]		-	-
0x2006:026	Error history buffer: Message 20	- (Read only)	general	OCTET[19]		-	-
0x2006:027	Error history buffer: Message 21	- (Read only)	general	OCTET[19]		-	-
0x2006:028	Error history buffer: Message 22	- (Read only)	general	OCTET[19]		-	-
0x2006:029	Error history buffer: Message 23	- (Read only)	general	OCTET[19]		-	-
0x2006:030	Error history buffer: Message 24	- (Read only)	general	OCTET[19]		-	-
0x2006:031	Error history buffer: Message 25	- (Read only)	general	OCTET[19]		-	-
0x2006:032	Error history buffer: Message 26	- (Read only)	general	OCTET[19]		-	-
0x2006:033	Error history buffer: Message 27	- (Read only)	general	OCTET[19]		-	-
0x2006:034	Error history buffer: Message 28	- (Read only)	general	OCTET[19]		-	-
0x2006:035	Error history buffer: Message 29	- (Read only)	general	OCTET[19]		-	-
0x2006:036	Error history buffer: Message 30	- (Read only)	general	OCTET[19]		-	-
0x2006:037	Error history buffer: Message 31	- (Read only)	general	OCTET[19]		-	-

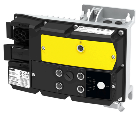
* Default setting dependent on the model.



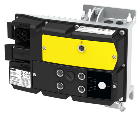
Address	Name	Default setting	Category	Data type	Factor	A	M
0x2007:001	Error history buffer: Message number	**1**	general	U8	1	-	-
0x2007:002	Error history buffer: Time stamp	x.xx s (Read only)	general	U32	100	-	-
0x2007:003	Error history buffer: Response to error	- (Read only)	general	U8	1	-	-
0x2007:004	Error history buffer: Message ID	- (Read only)	general	U16	1	-	-
0x2007:005	Error history buffer: Diag Code Ident	- (Read only)	general	U16	1	-	-
0x2007:006	Error history buffer: Message counter	- (Read only)	general	U8	1	-	-
0x2021:001	Optical tracking: Start detection	**Stop [0]**	general	U8	1	-	-
0x2021:002	Optical tracking: Blinking duration	**5 s**	general	U16	1	-	-
0x2022:001	Device commands: Load default settings	**Off / ready [0]**	general	U8	1	C	-
0x2022:003	Device commands: Save user data	**Off / ready [0]**	general	U8	1	-	-
0x2022:004	Device commands: Load user data	**Off / ready [0]**	general	U8	1	C	-
0x2022:005	Device commands: Load OEM data	**Off / ready [0]**	general	U8	1	C	-
0x2022:006	Device commands: Save OEM data	**Off / ready [0]**	general	U8	1	-	-
0x2022:007	Device commands: Load parameter set 1	**Off / ready [0]**	general	U8	1	-	-
0x2022:008	Device commands: Load parameter set 2	**Off / ready [0]**	general	U8	1	-	-
0x2022:009	Device commands: Load parameter set 3	**Off / ready [0]**	general	U8	1	-	-
0x2022:010	Device commands: Load parameter set 4	**Off / ready [0]**	general	U8	1	-	-
0x2022:011	Device commands: Save parameter set 1	**Off / ready [0]**	general	U8	1	-	-
0x2022:012	Device commands: Save parameter set 2	**Off / ready [0]**	general	U8	1	-	-
0x2022:013	Device commands: Save parameter set 3	**Off / ready [0]**	general	U8	1	-	-
0x2022:014	Device commands: Save parameter set 4	**Off / ready [0]**	general	U8	1	-	-
0x2022:015	Device commands: Delete logbook	**Off / ready [0]**	general	U8	1	X	-
0x2022:032	Device commands: Disable PDO Communication	**Off / ready [0]**	general	U8	1	-	-
0x2022:033	Device commands: Activate PDO Communication	**Off / ready [0]**	general	U8	1	-	-
0x2022:035	Device commands: Restart Device	**Off / ready [0]**	general	U8	1	XC	-
0x2030	CRC parameter set	- (Read only)	general	U32	1	-	-
0x231F:001	Communication module ID: Active module ID	- (Read only)	general	U8	1	-	-
0x231F:005	Communication module ID: Network selection	**0**	general	U8	1	C	-
0x2360	EtherCAT communication	**No action/no error [0]**	EtherCAT	U8	1	-	-
0x2361:004	EtherCAT settings: Device identifier	**0**	EtherCAT	U16	1	P	-
0x2362:001	Active EtherCAT settings: EoE IP address	- (Read only)	EtherCAT	U32	1	E	-
0x2362:002	Active EtherCAT settings: EoE subnet mask	- (Read only)	EtherCAT	U32	1	E	-
0x2362:003	Active EtherCAT settings: EoE gateway	- (Read only)	EtherCAT	U32	1	E	-
0x2362:004	Active EtherCAT settings: Device identifier	- (Read only)	EtherCAT	U16	1	-	-
0x2362:005	Active EtherCAT settings: EoE virtual MAC address	- (Read only)	EtherCAT	OCTET[6]		-	-
0x2362:006	Active EtherCAT settings: Station address	- (Read only)	EtherCAT	U16	1	-	-
0x2362:007	Active EtherCAT settings: Tx length	- (Read only)	EtherCAT	U16	1	-	-
0x2362:008	Active EtherCAT settings: Rx length	- (Read only)	EtherCAT	U16	1	-	-
0x2367:001	EtherCAT service status: Download parameter file	- (Read only)	EtherCAT	U8	1	-	-
0x2368	EtherCAT status	- (Read only)	EtherCAT	U16	1	-	-
0x2369	EtherCAT error	- (Read only)	EtherCAT	U16	1	-	-
0x2380	PROFINET communication	**No action/no error [0]**	PROFINET	U8	1	-	-
0x2381:001	PROFINET settings: IP address	**0.0.0.0**	PROFINET	U32	1	PE	-
0x2381:002	PROFINET settings: Subnet	**0.0.0.0**	PROFINET	U32	1	PE	-
0x2381:003	PROFINET settings: Gateway	**0.0.0.0**	PROFINET	U32	1	PE	-
0x2381:004	PROFINET settings: Station name	**"0"**	PROFINET	STRING[240]		P	-
0x2381:005	PROFINET settings: I&M1 System designation	**"0"**	PROFINET	STRING[32]		P	-
0x2381:006	PROFINET settings: I&M1 Installation site	**"0"**	PROFINET	STRING[22]		P	-
0x2381:007	PROFINET settings: I&M2 Installation date	**"0"**	PROFINET	STRING[16]		P	-
0x2381:008	PROFINET settings: I&M3 additional information	**"0"**	PROFINET	STRING[54]		P	-
0x2381:009	PROFINET settings: I&M4 signature code	**"0"**	PROFINET	OCTET[54]		P	-
0x2382:001	Active PROFINET settings: IP address	- (Read only)	PROFINET	U32	1	E	-
0x2382:002	Active PROFINET settings: Subnet	- (Read only)	PROFINET	U32	1	E	-
0x2382:003	Active PROFINET settings: Gateway	- (Read only)	PROFINET	U32	1	E	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x2382:004	Active PROFINET settings: Station name	- (Read only)	PROFINET	STRING[240]		-	-
0x2382:005	Active PROFINET settings: MAC Address	- (Read only)	PROFINET	OCTET[6]		-	-
0x2388	PROFINET status	- (Read only)	PROFINET	U16	1	-	-
0x2389:001	PROFINET error: Error 1	- (Read only)	PROFINET	U16	1	-	-
0x2389:002	PROFINET error: Error 2	- (Read only)	PROFINET	U16	1	-	-
0x23A0	EtherNet/IP communication	**No action/no error [0]**	EtherNet/IP	U8	1	-	-
0x23A1:001	EtherNet/IP settings: IP address	**192.168.124.16**	EtherNet/IP	U32	1	PE	-
0x23A1:002	EtherNet/IP settings: Subnet	**255.255.255.0**	EtherNet/IP	U32	1	PE	-
0x23A1:003	EtherNet/IP settings: Gateway	**0.0.0.0**	EtherNet/IP	U32	1	PE	-
0x23A1:004	EtherNet/IP settings: Host name	**"0"**	EtherNet/IP	STRING[64]		P	-
0x23A1:005	EtherNet/IP settings: IP configuration	**BOOTP [1]**	EtherNet/IP	U8	1	P	-
0x23A1:006	EtherNet/IP settings: Multicast TTL	**1**	EtherNet/IP	U8	1	P	-
0x23A1:007	EtherNet/IP settings: Multicast allocation	**Default allocation [0]**	EtherNet/IP	U8	1	P	-
0x23A1:008	EtherNet/IP settings: Multicast IP address	**239.64.2.224**	EtherNet/IP	U32	1	PE	-
0x23A1:009	EtherNet/IP settings: Multicast number	**1**	EtherNet/IP	U8	1	P	-
0x23A1:010	EtherNet/IP settings: Timeout	**10000 ms**	EtherNet/IP	U16	1	P	-
0x23A1:011	EtherNet/IP settings: Inactivity timeout	**120 s**	EtherNet/IP	U16	1	P	-
0x23A2:001	Active EtherNet/IP settings: IP address	- (Read only)	EtherNet/IP	U32	1	E	-
0x23A2:002	Active EtherNet/IP settings: Subnet	- (Read only)	EtherNet/IP	U32	1	E	-
0x23A2:003	Active EtherNet/IP settings: Gateway	- (Read only)	EtherNet/IP	U32	1	E	-
0x23A2:005	Active EtherNet/IP settings: MAC address	- (Read only)	EtherNet/IP	OCTET[6]		-	-
0x23A2:006	Active EtherNet/IP settings: Multicast address	- (Read only)	EtherNet/IP	U32	1	E	-
0x23A4:001	Port settings: Port 1	**Auto-Negotiation [0]**	EtherNet/IP	U16	1	P	-
0x23A4:002	Port settings: Port 2	**Auto-Negotiation [0]**	EtherNet/IP	U16	1	P	-
0x23A5:001	Active port settings: Port 1 (X266)	- (Read only)	EtherNet/IP	U16	1	-	-
0x23A5:002	Active port settings: Port 2 (X267)	- (Read only)	EtherNet/IP	U16	1	-	-
0x23A6	Quality of service	**802.1Q Tag disable [0]**	EtherNet/IP	U8	1	P	-
0x23A8	CIP module status	- (Read only)	EtherNet/IP	U16	1	-	-
0x23A9	EtherNet/IP status	- (Read only)	EtherNet/IP	U16	1	-	-
0x23AA:001	Address conflict settings: Detection	**Activated [1]**	EtherNet/IP	U8	1	P	-
0x23AA:002	Address conflict settings: Status	- (Read only)	EtherNet/IP	U8	1	-	-
0x23AA:003	Address conflict settings: Last conflicted MAC addr.	- (Read only)	EtherNet/IP	OCTET[6]		-	-
0x23AA:004	Address conflict settings: Last conflicted IP address	- (Read only)	EtherNet/IP	U32	1	E	-
0x23AB:001	DLR network diagnostics: Topology	- (Read only)	EtherNet/IP	U8	1	-	-
0x23AB:002	DLR network diagnostics: Status	- (Read only)	EtherNet/IP	U8	1	-	-
0x23AB:003	DLR network diagnostics: Supervisor IP address	- (Read only)	EtherNet/IP	U32	1	E	-
0x23AB:004	DLR network diagnostics: Supervisor MAC address	- (Read only)	EtherNet/IP	OCTET[6]		-	-
0x23AB:005	DLR network diagnostics: Beacon interval	x µs (Read only)	EtherNet/IP	U32	1	-	-
0x23AB:006	DLR network diagnostics: Beacon timeout	x µs (Read only)	EtherNet/IP	U32	1	-	-
0x23AB:007	DLR network diagnostics: Port1 beacon frames count.	- (Read only)	EtherNet/IP	U32	1	-	-
0x23AB:008	DLR network diagnostics: Port2 beacon frames count.	- (Read only)	EtherNet/IP	U32	1	-	-
0x23B0	Modbus TCP communication	**No action/no error [0]**	Modbus TCP	U8	1	-	-
0x23B1:001	Modbus -TCP/IP settings: IP address	**192.168.124.16**	Modbus TCP	U32	1	PE	-
0x23B1:002	Modbus -TCP/IP settings: Subnet	**255.255.255.0**	Modbus TCP	U32	1	PE	-
0x23B1:003	Modbus -TCP/IP settings: Gateway	**0.0.0.0**	Modbus TCP	U32	1	PE	-
0x23B1:005	Modbus -TCP/IP settings: IP configuration	**Stored IP [0]**	Modbus TCP	U8	1	P	-
0x23B1:006	Modbus -TCP/IP settings: Time-to-live value (TTL)	**32**	Modbus TCP	U8	1	P	-
0x23B1:010	Modbus -TCP/IP settings: Ethernet time-out	**10 s**	Modbus TCP	U16	1	P	-
0x23B1:011	Modbus -TCP/IP settings: Secondary port	**502**	Modbus TCP	U16	1	P	-
0x23B2:001	Active Modbus TCP settings: Active IP address	- (Read only)	Modbus TCP	U32	1	E	-
0x23B2:002	Active Modbus TCP settings: Active subnet	- (Read only)	Modbus TCP	U32	1	E	-
0x23B2:003	Active Modbus TCP settings: Active gateway	- (Read only)	Modbus TCP	U32	1	E	-
* Default setting dependent on the model.							

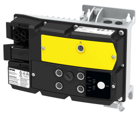


Address	Name	Default setting	Category	Data type	Factor	A	M
0x23B2:005	Active Modbus TCP settings: MAC address	- (Read only)	Modbus TCP	OCTET[6]		-	-
0x23B4:001	Port settings: Port 1	**Auto-Negotiation [0]**	Modbus TCP	U16	1	P	-
0x23B4:002	Port settings: Port 2	**Auto-Negotiation [0]**	Modbus TCP	U16	1	P	-
0x23B5:001	Active port settings: Port 1	- (Read only)	Modbus TCP	U16	1	-	-
0x23B5:002	Active port settings: Port 2	- (Read only)	Modbus TCP	U16	1	-	-
0x23B6:001	Time-out monitoring: Time-out time	**2.0 s**	Modbus TCP	U16	10	P	-
0x23B6:002	Time-out monitoring: Keep alive time-out time	**2.0 s**	Modbus TCP	U16	10	P	-
0x23B6:005	Time-out monitoring: Keep alive register	**0**	Modbus TCP	U16	1	K	-
0x23B8	Modbus TCP module status	- (Read only)	Modbus TCP	U16	1	-	-
0x23B9	Modbus TCP/IP network status	- (Read only)	Modbus TCP	U16	1	-	-
0x23BA:001	Modbus TCP statistics: Messages received	- (Read only)	Modbus TCP	U32	1	-	-
0x23BA:002	Modbus TCP statistics: Valid messages received	- (Read only)	Modbus TCP	U32	1	-	-
0x23BA:003	Modbus TCP statistics: Messages with exceptions	- (Read only)	Modbus TCP	U32	1	-	-
0x23BA:005	Modbus TCP statistics: Messages sent	- (Read only)	Modbus TCP	U32	1	-	-
0x23BB:001 ... 0x23BB:024	Modbus TCP/IP parameter mapping: Parameter 1 ... Parameter 24	**0**	Modbus TCP	IDX		PH	-
0x23BC:001 ... 0x23BC:024	Register assignment: Register 1 ... Register 24	- (Read only)	Modbus TCP	U16	1	-	-
0x23BD	Verification code	- (Read only)	Modbus TCP	U16	1	-	-
0x23BE:001	Modbus TCP/IP diagnostics of last Rx/Tx data: Receive offset	**0**	Modbus TCP	U8	1	-	-
0x23BE:002	Modbus TCP/IP diagnostics of last Rx/Tx data: Last Rx message	- (Read only)	Modbus TCP	OCTET[64]		-	-
0x23BE:003	Modbus TCP/IP diagnostics of last Rx/Tx data: Transmit offset	**0**	Modbus TCP	U8	1	-	-
0x23BE:004	Modbus TCP/IP diagnostics of last Rx/Tx data: Last Tx message	- (Read only)	Modbus TCP	OCTET[64]		-	-
0x24A1:001	IO-Link port 1: Current vendor ID	- (Read only)	general	U16	1	-	-
0x24A1:002	IO-Link port 1: Current device ID	- (Read only)	general	U32	1	-	-
0x24A1:003	IO-Link port 1: Product name	- (Read only)	general	STRING[65]		-	-
0x24A1:004	IO-Link port 1: Firmware version	- (Read only)	general	STRING[65]		-	-
0x24A1:005	IO-Link port 1: Serial number	- (Read only)	general	STRING[17]		-	-
0x24A1:011	IO-Link port 1: Vendor ID	**0**	general	U16	1	P	-
0x24A1:012	IO-Link port 1: Device ID	**0**	general	U32	1	P	-
0x24A1:013	IO-Link port 1: Validation method	**No check [0]**	general	U8	1	P	-
0x24A1:014	IO-Link port 1: Backup method	**No data storage [0]**	general	U8	1	P	-
0x24A1:015	IO-Link port 1: Revision ID	**0x00**	general	U8	1	PH	-
0x24A1:016	IO-Link port 1: Cycle time	**0.0 ms**	general	U16	10	P	-
0x24A1:021	IO-Link port 1: Communication status	- (Read only)	general	U8	1	-	-
0x24A1:022	IO-Link port 1: Current cycle time	x.x ms (Read only)	general	U16	10	-	-
0x24A1:023	IO-Link port 1: RPDO data length	- (Read only)	general	U8	1	-	-
0x24A1:024	IO-Link port 1: Received RPDO data	- (Read only)	general	OCTET[32]		-	-
0x24A1:025	IO-Link port 1: TPDO data length	- (Read only)	general	U8	1	-	-
0x24A1:026	IO-Link port 1: Transmitted TPDO data	**"0"**	general	OCTET[32]		X	-
0x24A1:027	IO-Link port 1: Enable TPDO data	**No action [0]**	general	U8	1	X	-
0x24A1:028	IO-Link port 1: Status PDO data	- (Read only)	general	U8	1	-	-
0x24A1:029	IO-Link port 1: SDCI protocol	- (Read only)	general	U8	1	H	-
0x24A1:030	IO-Link port 1: Transmission rate	- (Read only)	general	U8	1	-	-
0x24A1:047	IO-Link port 1: Error response	**No response [0]**	general	U8	1	P	-
0x24A1:048	IO-Link port 1: Warning response	**No response [0]**	general	U8	1	P	-
0x24A1:049	IO-Link port 1: Diagnostic data length	- (Read only)	general	U8	1	-	-
0x24A1:050	IO-Link port 1: Diagnostic entry 0	- (Read only)	general	U32	1	H	-
0x24A1:051	IO-Link port 1: Diagnostic entry 1	- (Read only)	general	U32	1	H	-
0x24A1:052	IO-Link port 1: Diagnostic entry 2	- (Read only)	general	U32	1	H	-
0x24A1:053	IO-Link port 1: Diagnostic entry 3	- (Read only)	general	U32	1	H	-
* Default setting dependent on the model.							

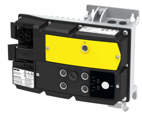


Address	Name	Default setting	Category	Data type	Factor	A	M
0x24A1:054	IO-Link port 1: Diagnostic entry 4	- (Read only)	general	U32	1	H	-
0x24A1:055	IO-Link port 1: Diagnostic entry 5	- (Read only)	general	U32	1	H	-
0x24A1:056	IO-Link port 1: Diagnostic entry 6	- (Read only)	general	U32	1	H	-
0x24A1:057	IO-Link port 1: Diagnostic entry 7	- (Read only)	general	U32	1	H	-
0x24A1:058	IO-Link port 1: Diagnostic entry 8	- (Read only)	general	U32	1	H	-
0x24A1:059	IO-Link port 1: Diagnostic entry 9	- (Read only)	general	U32	1	H	-
0x24A2:001	IO-Link port 2: Current vendor ID	- (Read only)	general	U16	1	-	-
0x24A2:002	IO-Link port 2: Current device ID	- (Read only)	general	U32	1	-	-
0x24A2:003	IO-Link port 2: Product name	- (Read only)	general	STRING[65]		-	-
0x24A2:004	IO-Link port 2: Firmware version	- (Read only)	general	STRING[65]		-	-
0x24A2:005	IO-Link port 2: Serial number	- (Read only)	general	STRING[17]		-	-
0x24A2:011	IO-Link port 2: Vendor ID	**0**	general	U16	1	P	-
0x24A2:012	IO-Link port 2: Device ID	**0**	general	U32	1	P	-
0x24A2:013	IO-Link port 2: Validation method	**No check [0]**	general	U8	1	P	-
0x24A2:014	IO-Link port 2: Backup method	**No data storage [0]**	general	U8	1	P	-
0x24A2:015	IO-Link port 2: Revision ID	**0x00**	general	U8	1	PH	-
0x24A2:016	IO-Link port 2: Cycle time	**0.0 ms**	general	U16	10	P	-
0x24A2:021	IO-Link port 2: Communication status	- (Read only)	general	U8	1	-	-
0x24A2:022	IO-Link port 2: Current cycle time	x.x ms (Read only)	general	U16	10	-	-
0x24A2:023	IO-Link port 2: RPDO data length	- (Read only)	general	U8	1	-	-
0x24A2:024	IO-Link port 2: Received RPDO data	- (Read only)	general	OCTET[32]		-	-
0x24A2:025	IO-Link port 2: TPDO data length	- (Read only)	general	U8	1	-	-
0x24A2:026	IO-Link port 2: Transmitted TPDO data	**"0"**	general	OCTET[32]		X	-
0x24A2:027	IO-Link port 2: Enable TPDO data	**No action [0]**	general	U8	1	X	-
0x24A2:028	IO-Link port 2: Status PDO data	- (Read only)	general	U8	1	-	-
0x24A2:029	IO-Link port 2: Lenght of diagnostic data	- (Read only)	general	U8	1	H	-
0x24A2:030	IO-Link port 2: Transmission rate	- (Read only)	general	U8	1	-	-
0x24A2:047	IO-Link port 2: Error response	**No response [0]**	general	U8	1	P	-
0x24A2:048	IO-Link port 2: Warning response	**No response [0]**	general	U8	1	P	-
0x24A2:049	IO-Link port 2: Diagnostic data length	- (Read only)	general	U8	1	-	-
0x24A2:050	IO-Link port 2: Diagnostic entry 0	- (Read only)	general	U32	1	H	-
0x24A2:051	IO-Link port 2: Diagnostic entry 1	- (Read only)	general	U32	1	H	-
0x24A2:052	IO-Link port 2: Diagnostic entry 2	- (Read only)	general	U32	1	H	-
0x24A2:053	IO-Link port 2: Diagnostic entry 3	- (Read only)	general	U32	1	H	-
0x24A2:054	IO-Link port 2: Diagnostic entry 4	- (Read only)	general	U32	1	H	-
0x24A2:055	IO-Link port 2: Diagnostic entry 5	- (Read only)	general	U32	1	H	-
0x24A2:056	IO-Link port 2: Diagnostic entry 6	- (Read only)	general	U32	1	H	-
0x24A2:057	IO-Link port 2: Diagnostic entry 7	- (Read only)	general	U32	1	H	-
0x24A2:058	IO-Link port 2: Diagnostic entry 8	- (Read only)	general	U32	1	H	-
0x24A2:059	IO-Link port 2: Diagnostic entry 9	- (Read only)	general	U32	1	H	-
0x24A3:001	IO-Link port 3: Current vendor ID	- (Read only)	general	U16	1	-	-
0x24A3:002	IO-Link port 3: Current device ID	- (Read only)	general	U32	1	-	-
0x24A3:003	IO-Link port 3: Product name	- (Read only)	general	STRING[65]		-	-
0x24A3:004	IO-Link port 3: Firmware version	- (Read only)	general	STRING[65]		-	-
0x24A3:005	IO-Link port 3: Serial number	- (Read only)	general	STRING[17]		-	-
0x24A3:011	IO-Link port 3: Vendor ID	**0**	general	U16	1	P	-
0x24A3:012	IO-Link port 3: Device ID	**0**	general	U32	1	P	-
0x24A3:013	IO-Link port 3: Validation method	**No check [0]**	general	U8	1	P	-
0x24A3:014	IO-Link port 3: Backup method	**No data storage [0]**	general	U8	1	P	-
0x24A3:015	IO-Link port 3: Revision ID	**0x00**	general	U8	1	PH	-
0x24A3:016	IO-Link port 3: Cycle time	**0.0 ms**	general	U16	10	P	-
0x24A3:021	IO-Link port 3: Communication status	- (Read only)	general	U8	1	-	-
0x24A3:022	IO-Link port 3: Current cycle time	x.x ms (Read only)	general	U16	10	-	-
0x24A3:023	IO-Link port 3: RPDO data length	- (Read only)	general	U8	1	-	-

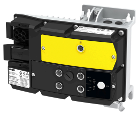
* Default setting dependent on the model.



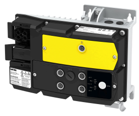
Address	Name	Default setting	Category	Data type	Factor	A	M
0x24A3:024	IO-Link port 3: Received RPDO data	- (Read only)	general	OCTET[32]		-	-
0x24A3:025	IO-Link port 3: TPDO data length	- (Read only)	general	U8	1	-	-
0x24A3:026	IO-Link port 3: Transmitted TPDO data	**"0"**	general	OCTET[32]		X	-
0x24A3:027	IO-Link port 3: Enable TPDO data	**No action [0]**	general	U8	1	X	-
0x24A3:028	IO-Link port 3: Status PDO data	- (Read only)	general	U8	1	-	-
0x24A3:029	IO-Link port 3: SDCI protocol	- (Read only)	general	U8	1	H	-
0x24A3:030	IO-Link port 3: Transmission rate	- (Read only)	general	U8	1	-	-
0x24A3:047	IO-Link port 3: Error response	**No response [0]**	general	U8	1	P	-
0x24A3:048	IO-Link port 3: Warning response	**No response [0]**	general	U8	1	P	-
0x24A3:049	IO-Link port 3: Diagnostic data length	- (Read only)	general	U8	1	-	-
0x24A3:050	IO-Link port 3: Diagnostic entry 0	- (Read only)	general	U32	1	H	-
0x24A3:051	IO-Link port 3: Diagnostic entry 1	- (Read only)	general	U32	1	H	-
0x24A3:052	IO-Link port 3: Diagnostic entry 2	- (Read only)	general	U32	1	H	-
0x24A3:053	IO-Link port 3: Diagnostic entry 3	- (Read only)	general	U32	1	H	-
0x24A3:054	IO-Link port 3: Diagnostic entry 4	- (Read only)	general	U32	1	H	-
0x24A3:055	IO-Link port 3: Diagnostic entry 5	- (Read only)	general	U32	1	H	-
0x24A3:056	IO-Link port 3: Diagnostic entry 6	- (Read only)	general	U32	1	H	-
0x24A3:057	IO-Link port 3: Diagnostic entry 7	- (Read only)	general	U32	1	H	-
0x24A3:058	IO-Link port 3: Diagnostic entry 8	- (Read only)	general	U32	1	H	-
0x24A3:059	IO-Link port 3: Diagnostic entry 9	- (Read only)	general	U32	1	H	-
0x24A4:001	IO-Link port 4: Current vendor ID	- (Read only)	general	U16	1	-	-
0x24A4:002	IO-Link port 4: Current device ID	- (Read only)	general	U32	1	-	-
0x24A4:003	IO-Link port 4: Product name	- (Read only)	general	STRING[65]		-	-
0x24A4:004	IO-Link port 4: Firmware version	- (Read only)	general	STRING[65]		-	-
0x24A4:005	IO-Link port 4: Serial number	- (Read only)	general	STRING[17]		-	-
0x24A4:011	IO-Link port 4: Vendor ID	**0**	general	U16	1	P	-
0x24A4:012	IO-Link port 4: Device ID	**0**	general	U32	1	P	-
0x24A4:013	IO-Link port 4: Validation method	**No check [0]**	general	U8	1	P	-
0x24A4:014	IO-Link port 4: Backup method	**No data storage [0]**	general	U8	1	P	-
0x24A4:015	IO-Link port 4: Revision ID	**0x00**	general	U8	1	PH	-
0x24A4:016	IO-Link port 4: Cycle time	**0.0 ms**	general	U16	10	P	-
0x24A4:021	IO-Link port 4: Communication status	- (Read only)	general	U8	1	-	-
0x24A4:022	IO-Link port 4: Current cycle time	x.x ms (Read only)	general	U16	10	-	-
0x24A4:023	IO-Link port 4: RPDO data length	- (Read only)	general	U8	1	-	-
0x24A4:024	IO-Link port 4: Received RPDO data	- (Read only)	general	OCTET[32]		-	-
0x24A4:025	IO-Link port 4: TPDO data length	- (Read only)	general	U8	1	-	-
0x24A4:026	IO-Link port 4: Transmitted TPDO data	**"0"**	general	OCTET[32]		X	-
0x24A4:027	IO-Link port 4: Enable TPDO data	**No action [0]**	general	U8	1	X	-
0x24A4:028	IO-Link port 4: Status PDO data	- (Read only)	general	U8	1	-	-
0x24A4:029	IO-Link port 4: SDCI protocol	- (Read only)	general	U8	1	H	-
0x24A4:030	IO-Link port 4: Transmission rate	- (Read only)	general	U8	1	-	-
0x24A4:047	IO-Link port 4: Error response	**No response [0]**	general	U8	1	P	-
0x24A4:048	IO-Link port 4: Warning response	**No response [0]**	general	U8	1	P	-
0x24A4:049	IO-Link port 4: Diagnostic data length	- (Read only)	general	U8	1	-	-
0x24A4:050	IO-Link port 4: Diagnostic entry 0	- (Read only)	general	U32	1	H	-
0x24A4:051	IO-Link port 4: Diagnostic entry 1	- (Read only)	general	U32	1	H	-
0x24A4:052	IO-Link port 4: Diagnostic entry 2	- (Read only)	general	U32	1	H	-
0x24A4:053	IO-Link port 4: Diagnostic entry 3	- (Read only)	general	U32	1	H	-
0x24A4:054	IO-Link port 4: Diagnostic entry 4	- (Read only)	general	U32	1	H	-
0x24A4:055	IO-Link port 4: Diagnostic entry 5	- (Read only)	general	U32	1	H	-
0x24A4:056	IO-Link port 4: Diagnostic entry 6	- (Read only)	general	U32	1	H	-
0x24A4:057	IO-Link port 4: Diagnostic entry 7	- (Read only)	general	U32	1	H	-
0x24A4:058	IO-Link port 4: Diagnostic entry 8	- (Read only)	general	U32	1	H	-
0x24A4:059	IO-Link port 4: Diagnostic entry 9	- (Read only)	general	U32	1	H	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x24D0:000	IOL1-RPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D0:001	IOL1-RPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D0:002	IOL1-RPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D0:003	IOL1-RPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D0:004	IOL1-RPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D0:005	IOL1-RPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D0:006	IOL1-RPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D0:007	IOL1-RPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D0:008	IOL1-RPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D0:009	IOL1-RPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D0:010	IOL1-RPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D0:011	IOL1-RPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D0:012	IOL1-RPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D0:013	IOL1-RPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D0:014	IOL1-RPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D0:015	IOL1-RPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D0:016	IOL1-RPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D1:000	IOL1-TPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D1:001	IOL1-TPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D1:002	IOL1-TPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D1:003	IOL1-TPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D1:004	IOL1-TPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D1:005	IOL1-TPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D1:006	IOL1-TPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D1:007	IOL1-TPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D1:008	IOL1-TPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D1:009	IOL1-TPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D1:010	IOL1-TPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D1:011	IOL1-TPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D1:012	IOL1-TPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D1:013	IOL1-TPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D1:014	IOL1-TPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D1:015	IOL1-TPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D1:016	IOL1-TPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D2:000	IOL2-RPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D2:001	IOL2-RPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D2:002	IOL2-RPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D2:003	IOL2-RPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D2:004	IOL2-RPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D2:005	IOL2-RPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D2:006	IOL2-RPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D2:007	IOL2-RPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D2:008	IOL2-RPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D2:009	IOL2-RPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D2:010	IOL2-RPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D2:011	IOL2-RPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D2:012	IOL2-RPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D2:013	IOL2-RPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D2:014	IOL2-RPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D2:015	IOL2-RPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D2:016	IOL2-RPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D3:000	IOL2-TPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D3:001	IOL2-TPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D3:002	IOL2-TPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
* Default setting dependent on the model.							

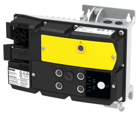


Address	Name	Default setting	Category	Data type	Factor	A	M
0x24D3:003	IOL2-TPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D3:004	IOL2-TPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D3:005	IOL2-TPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D3:006	IOL2-TPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D3:007	IOL2-TPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D3:008	IOL2-TPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D3:009	IOL2-TPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D3:010	IOL2-TPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D3:011	IOL2-TPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D3:012	IOL2-TPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D3:013	IOL2-TPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D3:014	IOL2-TPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D3:015	IOL2-TPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D3:016	IOL2-TPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D4:000	IOL3-RPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D4:001	IOL3-RPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D4:002	IOL3-RPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D4:003	IOL3-RPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D4:004	IOL3-RPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D4:005	IOL3-RPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D4:006	IOL3-RPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D4:007	IOL3-RPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D4:008	IOL3-RPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D4:009	IOL3-RPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D4:010	IOL3-RPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D4:011	IOL3-RPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D4:012	IOL3-RPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D4:013	IOL3-RPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D4:014	IOL3-RPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D4:015	IOL3-RPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D4:016	IOL3-RPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D5:000	IOL3-TPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D5:001	IOL3-TPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D5:002	IOL3-TPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D5:003	IOL3-TPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D5:004	IOL3-TPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D5:005	IOL3-TPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D5:006	IOL3-TPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D5:007	IOL3-TPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D5:008	IOL3-TPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D5:009	IOL3-TPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D5:010	IOL3-TPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D5:011	IOL3-TPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D5:012	IOL3-TPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D5:013	IOL3-TPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D5:014	IOL3-TPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D5:015	IOL3-TPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D5:016	IOL3-TPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D6:000	IOL4-RPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D6:001	IOL4-RPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D6:002	IOL4-RPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D6:003	IOL4-RPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D6:004	IOL4-RPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D6:005	IOL4-RPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
* Default setting dependent on the model.							

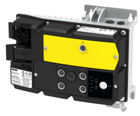


Address	Name	Default setting	Category	Data type	Factor	A	M
0x24D6:006	IOL4-RPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D6:007	IOL4-RPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D6:008	IOL4-RPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D6:009	IOL4-RPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D6:010	IOL4-RPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D6:011	IOL4-RPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D6:012	IOL4-RPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D6:013	IOL4-RPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D6:014	IOL4-RPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D6:015	IOL4-RPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D6:016	IOL4-RPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24D7:000	IOL4-TPDO mapping: Highest subindex	**0**	general	U8	1	P	-
0x24D7:001	IOL4-TPDO mapping: Entry 1	**0x00000000**	general	U32	1	PH	-
0x24D7:002	IOL4-TPDO mapping: Entry 2	**0x00000000**	general	U32	1	PH	-
0x24D7:003	IOL4-TPDO mapping: Entry 3	**0x00000000**	general	U32	1	PH	-
0x24D7:004	IOL4-TPDO mapping: Entry 4	**0x00000000**	general	U32	1	PH	-
0x24D7:005	IOL4-TPDO mapping: Entry 5	**0x00000000**	general	U32	1	PH	-
0x24D7:006	IOL4-TPDO mapping: Entry 6	**0x00000000**	general	U32	1	PH	-
0x24D7:007	IOL4-TPDO mapping: Entry 7	**0x00000000**	general	U32	1	PH	-
0x24D7:008	IOL4-TPDO mapping: Entry 8	**0x00000000**	general	U32	1	PH	-
0x24D7:009	IOL4-TPDO mapping: Entry 9	**0x00000000**	general	U32	1	PH	-
0x24D7:010	IOL4-TPDO mapping: Entry 10	**0x00000000**	general	U32	1	PH	-
0x24D7:011	IOL4-TPDO mapping: Entry 11	**0x00000000**	general	U32	1	PH	-
0x24D7:012	IOL4-TPDO mapping: Entry 12	**0x00000000**	general	U32	1	PH	-
0x24D7:013	IOL4-TPDO mapping: Entry 13	**0x00000000**	general	U32	1	PH	-
0x24D7:014	IOL4-TPDO mapping: Entry 14	**0x00000000**	general	U32	1	PH	-
0x24D7:015	IOL4-TPDO mapping: Entry 15	**0x00000000**	general	U32	1	PH	-
0x24D7:016	IOL4-TPDO mapping: Entry 16	**0x00000000**	general	U32	1	PH	-
0x24E5:001	Process data handling in case of error: Procedure	**Keep last data [0]**	general	U8	1	P	-
0x2539:001	Hardware-Diagnose: External supply voltage	x.x V (Read only)	general	U16	10	-	-
0x2540:001	Mains settings: Rated mains voltage	**230 Veff [0]**	general	U8	1	PC	-
0x2540:002	Mains settings: Undervoltage warning threshold	**0 V**	general	U16	1	P	-
0x2540:003	Mains settings: Undervoltage error threshold	x V (Read only)	general	U16	1	-	-
0x2540:004	Mains settings: Undervoltage reset threshold	x V (Read only)	general	U16	1	-	-
0x2540:005	Mains settings: Overvoltage warning threshold	**0 V**	general	U16	1	P	-
0x2540:006	Mains settings: Overvoltage error threshold	x V (Read only)	general	U16	1	-	-
0x2540:007	Mains settings: Overvoltage reset threshold	x V (Read only)	general	U16	1	-	-
0x261C:001	Favorites settings: Parameter 1	**769458176**	general	U32	1	P	-
0x261C:002	Favorites settings: Parameter 2	**1618477056**	general	U32	1	P	-
0x261C:003	Favorites settings: Parameter 3	**763953152**	general	U32	1	P	-
0x261C:004	Favorites settings: Parameter 4	**1614741504**	general	U32	1	P	-
0x261C:005	Favorites settings: Parameter 5	**673447936**	general	U32	1	P	-
0x261C:006	Favorites settings: Parameter 6	**677380352**	general	U32	1	P	-
0x261C:007	Favorites settings: Parameter 7	**674758912**	general	U32	1	P	-
0x261C:008	Favorites settings: Parameter 8	**674759424**	general	U32	1	P	-
0x261C:009	Favorites settings: Parameter 9	**624951552**	general	U32	1	P	-
0x261C:010	Favorites settings: Parameter 10	**689242112**	general	U32	1	P	-
0x261C:011	Favorites settings: Parameter 11	**689307648**	general	U32	1	P	-
0x261C:012	Favorites settings: Parameter 12	**689766656**	general	U32	1	P	-
0x261C:013	Favorites settings: Parameter 13	**689766912**	general	U32	1	P	-
0x261C:014	Favorites settings: Parameter 14	**738197504**	general	U32	1	P	-
0x261C:015	Favorites settings: Parameter 15	**721420288**	general	U32	1	P	-
0x261C:016	Favorites settings: Parameter 16	**721486080**	general	U32	1	P	-
0x261C:017	Favorites settings: Parameter 17	**721486336**	general	U32	1	P	-

* Default setting dependent on the model.



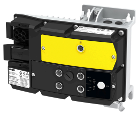
Address	Name	Default setting	Category	Data type	Factor	A	M
0x261C:018	Favorites settings: Parameter 18	**674889728**	general	U32	1	P	-
0x261C:019	Favorites settings: Parameter 19	**691601408**	general	U32	1	P	-
0x261C:020	Favorites settings: Parameter 20	**759890176**	general	U32	1	P	-
0x261C:021	Favorites settings: Parameter 21	**722600192**	general	U32	1	P	-
0x261C:022	Favorites settings: Parameter 22	**1618280448**	general	U32	1	P	-
0x261C:023	Favorites settings: Parameter 23	**1618149376**	general	U32	1	P	-
0x261C:024	Favorites settings: Parameter 24	**640745728**	general	U32	1	P	-
0x261C:025	Favorites settings: Parameter 25	**640745984**	general	U32	1	P	-
0x261C:026	Favorites settings: Parameter 26	**640746240**	general	U32	1	P	-
0x261C:027	Favorites settings: Parameter 27	**640746496**	general	U32	1	P	-
0x261C:028	Favorites settings: Parameter 28	**640746752**	general	U32	1	P	-
0x261C:029	Favorites settings: Parameter 29	**640747008**	general	U32	1	P	-
0x261C:030	Favorites settings: Parameter 30	**640747264**	general	U32	1	P	-
0x261C:031	Favorites settings: Parameter 31	**640747520**	general	U32	1	P	-
0x261C:032	Favorites settings: Parameter 32	**640747776**	general	U32	1	P	-
0x261C:033	Favorites settings: Parameter 33	**640748800**	general	U32	1	P	-
0x261C:034	Favorites settings: Parameter 34	**640750080**	general	U32	1	P	-
0x261C:035	Favorites settings: Parameter 35	**640750336**	general	U32	1	P	-
0x261C:036	Favorites settings: Parameter 36	**640750592**	general	U32	1	P	-
0x261C:037	Favorites settings: Parameter 37	**640942336**	general	U32	1	P	-
0x261C:038	Favorites settings: Parameter 38	**640942592**	general	U32	1	P	-
0x261C:039	Favorites settings: Parameter 39	**641073408**	general	U32	1	P	-
0x261C:040	Favorites settings: Parameter 40	**641073664**	general	U32	1	P	-
0x261C:041	Favorites settings: Parameter 41	**641073920**	general	U32	1	P	-
0x261C:042	Favorites settings: Parameter 42	**641270016**	general	U32	1	P	-
0x261C:043	Favorites settings: Parameter 43	**641270272**	general	U32	1	P	-
0x261C:044	Favorites settings: Parameter 44	**641270528**	general	U32	1	P	-
0x261C:045	Favorites settings: Parameter 45	**641270784**	general	U32	1	P	-
0x261C:046	Favorites settings: Parameter 46	**688980224**	general	U32	1	P	-
0x261C:047	Favorites settings: Parameter 47	**688980480**	general	U32	1	P	-
0x261C:048	Favorites settings: Parameter 48	**688980736**	general	U32	1	P	-
0x261C:049	Favorites settings: Parameter 49	**688980992**	general	U32	1	P	-
0x261C:050	Favorites settings: Parameter 50	**0**	general	U32	1	P	-
0x2630:001	Settings for digital inputs: Assertion level	**HIGH active [1]**	general	U8	1	P	-
0x2630:010	Settings for digital inputs: Plug X3.1 configuration	**DI2 + DI1 [1]**	general	U8	1	PC	-
0x2630:011	Settings for digital inputs: Plug X3.2 configuration	**DI4 + DI3 [1]**	general	U8	1	PC	-
0x2630:012	Settings for digital inputs: Plug X3.3 configuration	**DI6 + DI5 [1]**	general	U8	1	PC	-
0x2630:013	Settings for digital inputs: Plug X3.4 configuration	**DI8 + DI7 [1]**	general	U8	1	PC	-
0x2630:020	Settings for digital inputs: Overload error response	**Fault [23]**	general	U8	1	P	-
0x2631:001	Function list: Enable inverter	**Constant TRUE [1]**	general	U8	1	PC	-
0x2631:002	Function list: Run	**Digital input 1 [11]**	general	U8	1	PC	-
0x2631:003	Function list: Activate quick stop	**Not connected [0]**	general	U8	1	PC	-
0x2631:004	Function list: Reset fault	**Digital input 2 [12]**	general	U8	1	P	-
0x2631:005	Function list: Activate DC braking	**Not connected [0]**	general	U8	1	P	-
0x2631:006	Function list: Start forward (CW)	**Not connected [0]**	general	U8	1	PC	-
0x2631:007	Function list: Start reverse (CCW)	**Not connected [0]**	general	U8	1	PC	-
0x2631:008	Function list: Run forward (CW)	**Not connected [0]**	general	U8	1	PC	-
0x2631:009	Function list: Run reverse (CCW)	**Not connected [0]**	general	U8	1	PC	-
0x2631:010	Function list: Jog foward (CW)	**Not connected [0]**	general	U8	1	PC	-
0x2631:011	Function list: Jog reverse (CCW)	**Not connected [0]**	general	U8	1	PC	-
0x2631:013	Function list: Reverse rotational direction	**Digital input 3 [13]**	general	U8	1	PC	-
0x2631:017	Function list: Activate network setpoint	**Not connected [0]**	general	U8	1	P	-
0x2631:018	Function list: Activate preset (bit 0)	**Digital input 4 [14]**	general	U8	1	P	-
0x2631:019	Function list: Activate preset (bit 1)	**Not connected [0]**	general	U8	1	P	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x2631:020	Function list: Activate preset (bit 2)	**Not connected [0]**	general	U8	1	P	-
0x2631:021	Function list: Activate preset (bit 3)	**Not connected [0]**	general	U8	1	P	-
0x2631:023	Function list: MOP setpoint up	**Not connected [0]**	general	U8	1	P	-
0x2631:024	Function list: MOP setpoint down	**Not connected [0]**	general	U8	1	P	-
0x2631:025	Function list: Activate MOP setpoint	**Not connected [0]**	general	U8	1	P	-
0x2631:037	Function list: Activate network control	**Not connected [0]**	general	U8	1	P	-
0x2631:039	Function list: Activate ramp 2	**Not connected [0]**	general	U8	1	P	-
0x2631:040	Function list: Load parameter set	**Not connected [0]**	general	U8	1	PC	-
0x2631:041	Function list: Select parameter set (bit 0)	**Not connected [0]**	general	U8	1	PC	-
0x2631:042	Function list: Select parameter set (bit 1)	**Not connected [0]**	general	U8	1	PC	-
0x2631:043	Function list: Activate fault 1	**Not connected [0]**	general	U8	1	P	-
0x2631:044	Function list: Activate fault 2	**Not connected [0]**	general	U8	1	P	-
0x2631:045	Function list: Disable PID controller	**Not connected [0]**	general	U8	1	P	-
0x2631:046	Function list: Set process controller output to 0	**Not connected [0]**	general	U8	1	P	-
0x2631:047	Function list: Inhibit process controller I-component	**Not connected [0]**	general	U8	1	P	-
0x2631:048	Function list: Activate PID influence ramp	**Constant TRUE [1]**	general	U8	1	P	-
0x2631:049	Function list: Open holding brake	**Not connected [0]**	general	U8	1	PC	-
0x2631:054	Function list: Position counter reset	**Not connected [0]**	general	U8	1	P	-
0x2632:001	Inversion of digital inputs: Digital input 1	**Not inverted [0]**	general	U8	1	P	-
0x2632:002	Inversion of digital inputs: Digital input 2	**Not inverted [0]**	general	U8	1	P	-
0x2632:003	Inversion of digital inputs: Digital input 3	**Not inverted [0]**	general	U8	1	P	-
0x2632:004	Inversion of digital inputs: Digital input 4	**Not inverted [0]**	general	U8	1	P	-
0x2632:005	Inversion of digital inputs: Digital input 5	**Not inverted [0]**	general	U8	1	P	-
0x2632:006	Inversion of digital inputs: Digital input 6	**Not inverted [0]**	general	U8	1	P	-
0x2632:007	Inversion of digital inputs: Digital input 7	**Not inverted [0]**	general	U8	1	P	-
0x2632:008	Inversion of digital inputs: Digital input 8	**Not inverted [0]**	general	U8	1	P	-
0x2633:001	Digital input debounce time: Digital input 1	**1 ms**	general	U8	1	P	-
0x2633:002	Digital input debounce time: Digital input 2	**1 ms**	general	U8	1	P	-
0x2633:003	Digital input debounce time: Digital input 3	**1 ms**	general	U8	1	P	-
0x2633:004	Digital input debounce time: Digital input 4	**1 ms**	general	U8	1	P	-
0x2633:005	Digital input debounce time: Digital input 5	**1 ms**	general	U8	1	P	-
0x2633:006	Digital input debounce time: Digital input 6	**1 ms**	general	U8	1	P	-
0x2633:007	Digital input debounce time: Digital input 7	**1 ms**	general	U8	1	P	-
0x2633:008	Digital input debounce time: Digital input 8	**1 ms**	general	U8	1	P	-
0x2634:002	Digital outputs function: Digital output 1	**Operation enabled [52]**	general	U8	1	P	-
0x2634:003	Digital outputs function: Digital output 2	**Fault active [56]**	general	U8	1	P	-
0x2634:004	Digital outputs function: Digital output 3	**Not connected [0]**	general	U8	1	P	-
0x2634:005	Digital outputs function: Digital output 4	**Not connected [0]**	general	U8	1	P	-
0x2634:010	Digital outputs function: NetWordOUT1 - bit 0	**Ready for operation [51]**	general	U8	1	P	-
0x2634:011	Digital outputs function: NetWordOUT1 - bit 1	**Not connected [0]**	general	U8	1	P	-
0x2634:012	Digital outputs function: NetWordOUT1 - bit 2	**Operation enabled [52]**	general	U8	1	P	-
0x2634:013	Digital outputs function: NetWordOUT1 - bit 3	**Fault active [56]**	general	U8	1	P	-
0x2634:014	Digital outputs function: NetWordOUT1 - bit 4	**Not connected [0]**	general	U8	1	P	-
0x2634:015	Digital outputs function: NetWordOUT1 - bit 5	**Quick stop active [54]**	general	U8	1	P	-
0x2634:016	Digital outputs function: NetWordOUT1 - bit 6	**Running [50]**	general	U8	1	P	-
0x2634:017	Digital outputs function: NetWordOUT1 - bit 7	**Device warning active [58]**	general	U8	1	P	-
0x2634:018	Digital outputs function: NetWordOUT1 - bit 8	**Not connected [0]**	general	U8	1	P	-
0x2634:019	Digital outputs function: NetWordOUT1 - bit 9	**Not connected [0]**	general	U8	1	P	-
0x2634:020	Digital outputs function: NetWordOUT1 - bit 10	**Setpoint speed reached [72]**	general	U8	1	P	-
0x2634:021	Digital outputs function: NetWordOUT1 - bit 11	**Current limit reached [78]**	general	U8	1	P	-
0x2634:022	Digital outputs function: NetWordOUT1 - bit 12	**Actual speed = 0 [71]**	general	U8	1	P	-
0x2634:023	Digital outputs function: NetWordOUT1 - bit 13	**Rotational direction reversed [69]**	general	U8	1	P	-

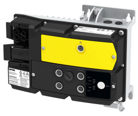
* Default setting dependent on the model.

Address	Name	Default setting	Category	Data type	Factor	A	M
0x2634:024	Digital outputs function: NetWordOUT1 - bit 14	**Not connected [0]**	general	U8	1	P	-
0x2634:025	Digital outputs function: NetWordOUT1 - bit 15	**Inverter disabled (safety) [55]**	general	U8	1	P	-
0x2635:002	Inversion of digital outputs: Digital output 1	**Not inverted [0]**	general	U8	1	P	-
0x2635:003	Inversion of digital outputs: Digital output 2	**Not inverted [0]**	general	U8	1	P	-
0x2635:004	Inversion of digital outputs: Digital output 3	**Not inverted [0]**	general	U8	1	P	-
0x2635:005	Inversion of digital outputs: Digital output 4	**Not inverted [0]**	general	U8	1	P	-
0x2635:010	Inversion of digital outputs: NetWordOUT1.00	**Not inverted [0]**	general	U8	1	P	-
0x2635:011	Inversion of digital outputs: NetWordOUT1.01	**Not inverted [0]**	general	U8	1	P	-
0x2635:012	Inversion of digital outputs: NetWordOUT1.02	**Not inverted [0]**	general	U8	1	P	-
0x2635:013	Inversion of digital outputs: NetWordOUT1.03	**Not inverted [0]**	general	U8	1	P	-
0x2635:014	Inversion of digital outputs: NetWordOUT1.04	**Not inverted [0]**	general	U8	1	P	-
0x2635:015	Inversion of digital outputs: NetWordOUT1.05	**Not inverted [0]**	general	U8	1	P	-
0x2635:016	Inversion of digital outputs: NetWordOUT1.06	**Not inverted [0]**	general	U8	1	P	-
0x2635:017	Inversion of digital outputs: NetWordOUT1.07	**Not inverted [0]**	general	U8	1	P	-
0x2635:018	Inversion of digital outputs: NetWordOUT1.08	**Not inverted [0]**	general	U8	1	P	-
0x2635:019	Inversion of digital outputs: NetWordOUT1.09	**Not inverted [0]**	general	U8	1	P	-
0x2635:020	Inversion of digital outputs: NetWordOUT1.10	**Not inverted [0]**	general	U8	1	P	-
0x2635:021	Inversion of digital outputs: NetWordOUT1.11	**Not inverted [0]**	general	U8	1	P	-
0x2635:022	Inversion of digital outputs: NetWordOUT1.12	**Not inverted [0]**	general	U8	1	P	-
0x2635:023	Inversion of digital outputs: NetWordOUT1.13	**Not inverted [0]**	general	U8	1	P	-
0x2635:024	Inversion of digital outputs: NetWordOUT1.14	**Not inverted [0]**	general	U8	1	P	-
0x2635:025	Inversion of digital outputs: NetWordOUT1.15	**Not inverted [0]**	general	U8	1	P	-
0x2640:009	HTL input settings: Filter time constant	**10 ms**	general	U16	1	P	-
0x2641:001	HTL input monitoring: Minimum frequency threshold	**0.0 Hz**	general	S32	10	P	-
0x2641:002	HTL input monitoring: Minimum delay threshold	**5.0 s**	general	U16	10	P	-
0x2641:003	HTL input monitoring: Maximum frequency threshold	**0.0 Hz**	general	S32	10	P	-
0x2641:004	HTL input monitoring: Maximum delay threshold	**5.0 s**	general	U16	10	P	-
0x2641:005	HTL input monitoring: Monitoring conditions	**Below minimum frequency [1]**	general	U8	1	P	-
0x2641:006	HTL input monitoring: Error response	**No response [0]**	general	U8	1	P	-
0x2642:001	HTL input diagnostics: Input frequency	x.x Hz (Read only)	general	S32	10	-	t
0x2644:003	DO1 frequency setup: Function	**Not active [0]**	general	U8	1	-	-
0x2646:001	DO actual frequency: Digital output 1	x.x Hz (Read only)	general	S32	10	-	t
0x2650:001	Binary input configuration: X3.1 IOL1 BI1 value	- (Read only)	general	U8	1	-	r
0x2650:002	Binary input configuration: X3.1 IOL1 BI1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:003	Binary input configuration: X3.1 IOL1 BI2 value	- (Read only)	general	U8	1	-	r
0x2650:004	Binary input configuration: X3.1 IOL1 BI2 inverted	**Not inverted [0]**	general	U8	1	P	-
0x2650:005	Binary input configuration: X3.1 IOL1 BI3 value	- (Read only)	general	U8	1	-	r
0x2650:006	Binary input configuration: X3.1 IOL1 BI3 inverted	**Not inverted [0]**	general	U8	1	P	-
0x2650:007	Binary input configuration: X3.1 IOL1 BI4 value	- (Read only)	general	U8	1	-	r
0x2650:008	Binary input configuration: X3.1 IOL1 BI4 inverted	**Not inverted [0]**	general	U8	1	P	-
0x2650:009	Binary input configuration: X3.1 IOL1 BI5 value	- (Read only)	general	U8	1	-	r
0x2650:010	Binary input configuration: X3.1 IOL1 BI5 inverted	**Not inverted [0]**	general	U8	1	P	-
0x2650:011	Binary input configuration: X3.1 IOL1 BI6 value	- (Read only)	general	U8	1	-	r
0x2650:012	Binary input configuration: X3.1 IOL1 BI6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:013	Binary input configuration: X3.1 IOL1 BI7 value	- (Read only)	general	U8	1	-	r
0x2650:014	Binary input configuration: X3.1 IOL1 BI7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:015	Binary input configuration: X3.1 IOL1 BI8 value	- (Read only)	general	U8	1	-	r
0x2650:016	Binary input configuration: X3.1 IOL1 BI8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:017	Binary input configuration: X3.2 IOL2 BI1 value	- (Read only)	general	U8	1	-	r
0x2650:018	Binary input configuration: X3.2 IOL2 BI1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:019	Binary input configuration: X3.2 IOL2 BI2 value	- (Read only)	general	U8	1	-	r
* Default setting dependent on the model.							

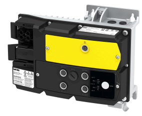


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2650:020	Binary input configuration: X3.2 IOL2 BI2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:021	Binary input configuration: X3.2 IOL2 BI3 value	- (Read only)	general	U8	1	-	r
0x2650:022	Binary input configuration: X3.2 IOL2 BI3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:023	Binary input configuration: X3.2 IOL2 BI4 value	- (Read only)	general	U8	1	-	r
0x2650:024	Binary input configuration: X3.2 IOL2 BI4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:025	Binary input configuration: X3.2 IOL2 BI5 value	- (Read only)	general	U8	1	-	r
0x2650:026	Binary input configuration: X3.2 IOL2 BI5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:027	Binary input configuration: X3.2 IOL2 BI6 value	- (Read only)	general	U8	1	-	r
0x2650:028	Binary input configuration: X3.2 IOL2 BI6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:029	Binary input configuration: X3.2 IOL2 BI7 value	- (Read only)	general	U8	1	-	r
0x2650:030	Binary input configuration: X3.2 IOL2 BI7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:031	Binary input configuration: X3.2 IOL2 BI8 value	- (Read only)	general	U8	1	-	r
0x2650:032	Binary input configuration: X3.2 IOL2 BI8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:033	Binary input configuration: X3.3 IOL3 BI1 value	- (Read only)	general	U8	1	-	r
0x2650:034	Binary input configuration: X3.3 IOL3 BI1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:035	Binary input configuration: X3.3 IOL3 BI2 value	- (Read only)	general	U8	1	-	r
0x2650:036	Binary input configuration: X3.3 IOL3 BI2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:037	Binary input configuration: X3.3 IOL3 BI3 value	- (Read only)	general	U8	1	-	r
0x2650:038	Binary input configuration: X3.3 IOL3 BI3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:039	Binary input configuration: X3.3 IOL3 BI4 value	- (Read only)	general	U8	1	-	r
0x2650:040	Binary input configuration: X3.3 IOL3 BI4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:041	Binary input configuration: X3.3 IOL3 BI5 value	- (Read only)	general	U8	1	-	r
0x2650:042	Binary input configuration: X3.3 IOL3 BI5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:043	Binary input configuration: X3.3 IOL3 BI6 value	- (Read only)	general	U8	1	-	r
0x2650:044	Binary input configuration: X3.3 IOL3 BI6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:045	Binary input configuration: X3.3 IOL3 BI7 value	- (Read only)	general	U8	1	-	r
0x2650:046	Binary input configuration: X3.3 IOL3 BI7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:047	Binary input configuration: X3.3 IOL3 BI8 value	- (Read only)	general	U8	1	-	r
0x2650:048	Binary input configuration: X3.3 IOL3 BI8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:049	Binary input configuration: X3.4 IOL4 BI1 value	- (Read only)	general	U8	1	-	r
0x2650:050	Binary input configuration: X3.4 IOL4 BI1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:051	Binary input configuration: X3.4 IOL4 BI2 value	- (Read only)	general	U8	1	-	r
0x2650:052	Binary input configuration: X3.4 IOL4 BI2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:053	Binary input configuration: X3.4 IOL4 BI3 value	- (Read only)	general	U8	1	-	r
0x2650:054	Binary input configuration: X3.4 IOL4 BI3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:055	Binary input configuration: X3.4 IOL4 BI4 value	- (Read only)	general	U8	1	-	r
0x2650:056	Binary input configuration: X3.4 IOL4 BI4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:057	Binary input configuration: X3.4 IOL4 BI5 value	- (Read only)	general	U8	1	-	r
0x2650:058	Binary input configuration: X3.4 IOL4 BI5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:059	Binary input configuration: X3.4 IOL4 BI6 value	- (Read only)	general	U8	1	-	r
0x2650:060	Binary input configuration: X3.4 IOL4 BI6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:061	Binary input configuration: X3.4 IOL4 BI7 value	- (Read only)	general	U8	1	-	r
0x2650:062	Binary input configuration: X3.4 IOL4 BI7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2650:063	Binary input configuration: X3.4 IOL4 BI8 value	- (Read only)	general	U8	1	-	r
0x2650:064	Binary input configuration: X3.4 IOL4 BI8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:001	Binary output configuration: X3.1 IOL1 BO1 value	- (Read only)	general	U8	1	-	t
0x2651:002	Binary output configuration: X3.1 IOL1 BO1 source	**Not connected [0]**	general	U8	1	P	-
0x2651:003	Binary output configuration: X3.1 IOL1 BO1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:005	Binary output configuration: X3.1 IOL1 BO2 value	- (Read only)	general	U8	1	-	t
0x2651:006	Binary output configuration: X3.1 IOL1 BO2 source	**Not connected [0]**	general	U8	1	P	-
0x2651:007	Binary output configuration: X3.1 IOL1 BO2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:009	Binary output configuration: X3.1 IOL3 BO3 value	- (Read only)	general	U8	1	-	t

* Default setting dependent on the model.



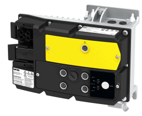
Address	Name	Default setting	Category	Data type	Factor	A	M
0x2651:010	Binary output configuration: X3.1 IOL3 BO3 source	**Not connected [0]**	general	U8	1	P	-
0x2651:011	Binary output configuration: X3.1 IOL1 BO3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:013	Binary output configuration: X3.1 IOL1 BO4 value	- (Read only)	general	U8	1	-	t
0x2651:014	Binary output configuration: X3.1 IOL1 BO4 source	**Not connected [0]**	general	U8	1	P	-
0x2651:015	Binary output configuration: X3.1 IOL1 BO4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:017	Binary output configuration: X3.1 IOL1 BO5 value	- (Read only)	general	U8	1	-	t
0x2651:018	Binary output configuration: X3.1 IOL1 BO5 source	**Not connected [0]**	general	U8	1	P	-
0x2651:019	Binary output configuration: X3.1 IOL1 BO5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:021	Binary output configuration: X3.1 IOL1 BO6 value	- (Read only)	general	U8	1	-	t
0x2651:022	Binary output configuration: X3.1 IOL1 BO6 source	**Not connected [0]**	general	U8	1	P	-
0x2651:023	Binary output configuration: X3.1 IOL1 BO6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:025	Binary output configuration: X3.1 IOL1 BO7 value	- (Read only)	general	U8	1	-	t
0x2651:026	Binary output configuration: X3.1 IOL1 BO7 source	**Not connected [0]**	general	U8	1	P	-
0x2651:027	Binary output configuration: X3.1 IOL1 BIO7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:029	Binary output configuration: X3.1 IOL1 BO8 value	- (Read only)	general	U8	1	-	t
0x2651:030	Binary output configuration: X3.1 IOL1 BO8 source	**Not connected [0]**	general	U8	1	P	-
0x2651:031	Binary output configuration: X3.1 IOL1 BO8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:033	Binary output configuration: X3.2 IOL2 BO1 value	- (Read only)	general	U8	1	-	t
0x2651:034	Binary output configuration: X3.2 IOL2 BO1 source	**Not connected [0]**	general	U8	1	P	-
0x2651:035	Binary output configuration: X3.2 IOL2 BO1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:037	Binary output configuration: X3.2 IOL2 BO2 value	- (Read only)	general	U8	1	-	t
0x2651:038	Binary output configuration: X3.2 IOL2 BO2 source	**Not connected [0]**	general	U8	1	P	-
0x2651:039	Binary output configuration: X3.2 IOL2 BO2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:041	Binary output configuration: X3.2 IOL2 BO3 value	- (Read only)	general	U8	1	-	t
0x2651:042	Binary output configuration: X3.2 IOL2 BO3 source	**Not connected [0]**	general	U8	1	P	-
0x2651:043	Binary output configuration: X3.2 IOL2 BO3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:045	Binary output configuration: X3.2 IOL2 BO4 value	- (Read only)	general	U8	1	-	t
0x2651:046	Binary output configuration: X3.2 IOL2 BO4 source	**Not connected [0]**	general	U8	1	P	-
0x2651:047	Binary output configuration: X3.2 IOL2 BO4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:049	Binary output configuration: X3.2 IOL2 BO5 value	- (Read only)	general	U8	1	-	t
0x2651:050	Binary output configuration: X3.2 IOL2 BO5 source	**Not connected [0]**	general	U8	1	P	-
0x2651:051	Binary output configuration: X3.2 IOL2 BO5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:053	Binary output configuration: X3.2 IOL2 BO6 value	- (Read only)	general	U8	1	-	t
0x2651:054	Binary output configuration: X3.2 IOL2 BO6 source	**Not connected [0]**	general	U8	1	P	-
0x2651:055	Binary output configuration: X3.2 IOL2 BO6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:057	Binary output configuration: X3.2 IOL2 BO7 value	- (Read only)	general	U8	1	-	t
0x2651:058	Binary output configuration: X3.2 IOL2 BO7 source	**Not connected [0]**	general	U8	1	P	-
0x2651:059	Binary output configuration: X3.2 IOL2 BO7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:061	Binary output configuration: X3.2 IOL2 BO8 value	- (Read only)	general	U8	1	-	t
0x2651:062	Binary output configuration: X3.2 IOL2 BO8 source	**Not connected [0]**	general	U8	1	P	-
0x2651:063	Binary output configuration: X3.2 IOL2 BO8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:065	Binary output configuration: X3.3 IOL3 BO1 value	- (Read only)	general	U8	1	-	t
0x2651:066	Binary output configuration: X3.3 IOL3 BO1 source	**Not connected [0]**	general	U8	1	P	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x2651:067	Binary output configuration: X3.3 IOL3 BO1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:069	Binary output configuration: X3.3 IOL3 BO2 value	- (Read only)	general	U8	1	-	t
0x2651:070	Binary output configuration: X3.3 IOL3 BO2 source	**Not connected [0]**	general	U8	1	P	-
0x2651:071	Binary output configuration: X3.3 IOL3 BO2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:073	Binary output configuration: X3.3 IOL3 BO3 value	- (Read only)	general	U8	1	-	t
0x2651:074	Binary output configuration: X3.3 IOL3 BO3 source	**Not connected [0]**	general	U8	1	P	-
0x2651:075	Binary output configuration: X3.3 IOL3 BO3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:077	Binary output configuration: X3.3 IOL3 BO4 value	- (Read only)	general	U8	1	-	t
0x2651:078	Binary output configuration: X3.3 IOL3 BO4 source	**Not connected [0]**	general	U8	1	P	-
0x2651:079	Binary output configuration: X3.3 IOL3 BO4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:081	Binary output configuration: X3.3 IOL3 BO5 value	- (Read only)	general	U8	1	-	t
0x2651:082	Binary output configuration: X3.3 IOL3 BO5 source	**Not connected [0]**	general	U8	1	P	-
0x2651:083	Binary output configuration: X3.3 IOL3 BO5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:085	Binary output configuration: X3.3 IOL3 BO6 value	- (Read only)	general	U8	1	-	t
0x2651:086	Binary output configuration: X3.3 IOL3 BO6 source	**Not connected [0]**	general	U8	1	P	-
0x2651:087	Binary output configuration: X3.3 IOL3 BO6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:089	Binary output configuration: X3.3 IOL3 BO7 value	- (Read only)	general	U8	1	-	t
0x2651:090	Binary output configuration: X3.3 IOL3 BO7 source	**Not connected [0]**	general	U8	1	P	-
0x2651:091	Binary output configuration: X3.3 IOL3 BO7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:093	Binary output configuration: X3.3 IOL3 BO8 value	- (Read only)	general	U8	1	-	t
0x2651:094	Binary output configuration: X3.3 IOL3 BO8 source	**Not connected [0]**	general	U8	1	P	-
0x2651:095	Binary output configuration: X3.3 IOL3 BO8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:097	Binary output configuration: X3.4 IOL4 BO1 value	- (Read only)	general	U8	1	-	t
0x2651:098	Binary output configuration: X3.4 IOL4 BO1 source	**Not connected [0]**	general	U8	1	P	-
0x2651:099	Binary output configuration: X3.4 IOL4 BO1 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:101	Binary output configuration: X3.4 IOL4 BO2 value	- (Read only)	general	U8	1	-	t
0x2651:102	Binary output configuration: X3.4 IOL4 BO2 source	**Not connected [0]**	general	U8	1	P	-
0x2651:103	Binary output configuration: X3.4 IOL4 BO2 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:105	Binary output configuration: X3.4 IOL4 BO3 value	- (Read only)	general	U8	1	-	t
0x2651:106	Binary output configuration: X3.4 IOL4 BO3 source	**Not connected [0]**	general	U8	1	P	-
0x2651:107	Binary output configuration: X3.4 IOL4 BO3 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:109	Binary output configuration: X3.4 IOL4 BO4 value	- (Read only)	general	U8	1	-	t
0x2651:110	Binary output configuration: X3.4 IOL4 BO4 source	**Not connected [0]**	general	U8	1	P	-
0x2651:111	Binary output configuration: X3.4 IOL4 BO4 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:113	Binary output configuration: X3.4 IOL4 BO5 value	- (Read only)	general	U8	1	-	t
0x2651:114	Binary output configuration: X3.4 IOL4 BO5 source	**Not connected [0]**	general	U8	1	P	-
0x2651:115	Binary output configuration: X3.4 IOL4 BO5 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:117	Binary output configuration: X3.4 IOL4 BO6 value	- (Read only)	general	U8	1	-	t
0x2651:118	Binary output configuration: X3.4 IOL4 BO6 source	**Not connected [0]**	general	U8	1	P	-
0x2651:119	Binary output configuration: X3.4 IOL4 BO6 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:121	Binary output configuration: X3.4 IOL4 BO7 value	- (Read only)	general	U8	1	-	t
0x2651:122	Binary output configuration: X3.4 IOL4 BO7 source	**Not connected [0]**	general	U8	1	P	-

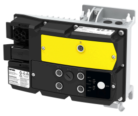
* Default setting dependent on the model.

Address	Name	Default setting	Category	Data type	Factor	A	M
0x2651:123	Binary output configuration: X3.4 IOL4 BO7 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2651:125	Binary output configuration: X3.4 IOL4 BO8 value	- (Read only)	general	U8	1	-	t
0x2651:126	Binary output configuration: X3.4 IOL4 BO8 source	**Not connected [0]**	general	U8	1	P	-
0x2651:127	Binary output configuration: X3.4 IOL4 BO8 inversion	**Not inverted [0]**	general	U8	1	P	-
0x2652:002	Analog input configuration: X3.1 IOL1 AI1 source value	- (Read only)	general	S32	1	-	r
0x2652:003	Analog input configuration: X3.1 IOL1 AI1 target address	**0**	general	U32	1	P	-
0x2652:004	Analog input configuration: X3.1 IOL1 AI1 scaled value	- (Read only)	general	S32	1	-	t
0x2652:005	Analog input configuration: X3.1 IOL1 AI1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:006	Analog input configuration: X3.1 IOL1 AI1 bits input	**16**	general	U8	1	P	-
0x2652:007	Analog input configuration: X3.1 IOL1 AI1 scaling #A1min	**0**	general	S32	1	P	-
0x2652:008	Analog input configuration: X3.1 IOL1 AI1 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:009	Analog input configuration: X3.1 IOL1 AI1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:010	Analog input configuration: X3.1 IOL1 AI1 bits output	**16**	general	U8	1	P	-
0x2652:011	Analog input configuration: X3.1 IOL1 AI1 scaling #B1min	**0**	general	S32	1	P	-
0x2652:012	Analog input configuration: X3.1 IOL1 AI1 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:015	Analog input configuration: X3.1 IOL1 AI1 status	**Inactive [0]**	general	U8	1	P	-
0x2652:017	Analog input configuration: X3.1 IOL1 AI2 source value	- (Read only)	general	S32	1	-	r
0x2652:018	Analog input configuration: X3.1 IOL1 AI2 target address	**0**	general	U32	1	P	-
0x2652:019	Analog input configuration: X3.1 IOL1 AI2 scaled value	- (Read only)	general	S32	1	-	t
0x2652:020	Analog input configuration: X3.1 IOL1 AI2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:021	Analog input configuration: X3.1 IOL1 AI2 bits input	**16**	general	U8	1	P	-
0x2652:022	Analog input configuration: X3.1 IOL1 AI2 scaling #A1min	**0**	general	S32	1	P	-
0x2652:023	Analog input configuration: X3.1 IOL1 AI2 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:024	Analog input configuration: X3.1 IOL1 AI2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:025	Analog input configuration: X3.1 IOL1 AI2 bits output	**16**	general	U8	1	P	-
0x2652:026	Analog input configuration: X3.1 IOL1 AI2 scaling #B1min	**0**	general	S32	1	P	-
0x2652:027	Analog input configuration: X3.1 IOL1 AI2 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:030	Analog input configuration: X3.1 IOL1 AI2 status	**Inactive [0]**	general	U8	1	P	-
0x2652:032	Analog input configuration: X3.2 IOL2 AI1 source value	- (Read only)	general	S32	1	-	r
0x2652:033	Analog input configuration: X3.2 IOL2 AI1 target address	**0**	general	U32	1	P	-
0x2652:034	Analog input configuration: X3.2 IOL2 AI1 scaled value	- (Read only)	general	S32	1	-	t
0x2652:035	Analog input configuration: X3.2 IOL2 AI1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:036	Analog input configuration: X3.2 IOL2 AI2 bits input	**16**	general	U8	1	P	-
* Default setting dependent on the model.							



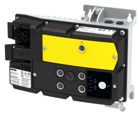
Address	Name	Default setting	Category	Data type	Factor	A	M
0x2652:037	Analog input configuration: X3.2 IOL2 AI1 scaling #A1min	**0**	general	S32	1	P	-
0x2652:038	Analog input configuration: X3.2 IOL2 AI1 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:039	Analog input configuration: X3.2 IOL2 AI1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:040	Analog input configuration: X3.2 IOL2 AI1 bits output	**16**	general	U8	1	P	-
0x2652:041	Analog input configuration: X3.2 IOL2 AI1 scaling #B1min	**0**	general	S32	1	P	-
0x2652:042	Analog input configuration: X3.2 IOL2 AI1 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:045	Analog input configuration: X3.2 IOL2 AI1 status	**Inactive [0]**	general	U8	1	P	-
0x2652:047	Analog input configuration: X3.2 IOL2 AI2 source value	- (Read only)	general	S32	1	-	r
0x2652:048	Analog input configuration: X3.2 IOL2 AI2 target address	**0**	general	U32	1	P	-
0x2652:049	Analog input configuration: X3.2 IOL2 AI2 scaled value	- (Read only)	general	S32	1	-	t
0x2652:050	Analog input configuration: X3.2 IOL2 AI2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:051	Analog input configuration: X3.2 IOL2 AI2 bits input	**16**	general	U8	1	P	-
0x2652:052	Analog input configuration: X3.2 IOL2 AI2 scaling #A1min	**0**	general	S32	1	P	-
0x2652:053	Analog input configuration: X3.2 IOL2 AI2 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:054	Analog input configuration: X3.2 IOL2 AI2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:055	Analog input configuration: X3.2 IOL2 AI2 bits output	**16**	general	U8	1	P	-
0x2652:056	Analog input configuration: X3.2 IOL2 AI2 scaling #B1min	**0**	general	S32	1	P	-
0x2652:057	Analog input configuration: X3.2 IOL2 AI2 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:060	Analog input configuration: X3.2 IOL2 AI2 status	**Inactive [0]**	general	U8	1	P	-
0x2652:062	Analog input configuration: X3.3 IOL3 AI1 source value	- (Read only)	general	S32	1	-	r
0x2652:063	Analog input configuration: X3.3 IOL3 AI1 target address	**0**	general	U32	1	P	-
0x2652:064	Analog input configuration: X3.3 IOL3 AI1 scaled value	- (Read only)	general	S32	1	-	t
0x2652:065	Analog input configuration: X3.3 IOL3 AI1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:066	Analog input configuration: X3.3 IOL3 AI1 bits input	**16**	general	U8	1	P	-
0x2652:067	Analog input configuration: X3.3 IOL3 AI1 scaling #A1min	**0**	general	S32	1	P	-
0x2652:068	Analog input configuration: X3.3 IOL3 AI1 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:069	Analog input configuration: X3.3 IOL3 AI1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:070	Analog input configuration: X3.3 IOL3 AI1 bits output	**16**	general	U8	1	P	-
0x2652:071	Analog input configuration: X3.3 IOL3 AI1 scaling #B1min	**0**	general	S32	1	P	-
0x2652:072	Analog input configuration: X3.3 IOL3 AI1 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:075	Analog input configuration: X3.3 IOL3 AI1 status	**Inactive [0]**	general	U8	1	P	-
0x2652:077	Analog input configuration: X3.3 IOL3 AI2 source value	- (Read only)	general	S32	1	-	r

* Default setting dependent on the model.

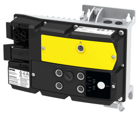


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2652:078	Analog input configuration: X3.3 IOL3 AI2 target address	**0**	general	U32	1	P	-
0x2652:079	Analog input configuration: X3.3 IOL3 AI2 scaled value	- (Read only)	general	S32	1	-	t
0x2652:080	Analog input configuration: X3.3 IOL3 AI2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:081	Analog input configuration: X3.3 IOL3 AI2 bits input	**16**	general	U8	1	P	-
0x2652:082	Analog input configuration: X3.3 IOL3 AI2 scaling #A1min	**0**	general	S32	1	P	-
0x2652:083	Analog input configuration: X3.3 IOL3 AI2 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:084	Analog input configuration: X3.3 IOL3 AI2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:085	Analog input configuration: X3.3 IOL3 AI2 bits output	**16**	general	U8	1	P	-
0x2652:086	Analog input configuration: X3.3 IOL3 AI2 scaling #B1min	**0**	general	S32	1	P	-
0x2652:087	Analog input configuration: X3.3 IOL3 AI2 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:090	Analog input configuration: X3.3 IOL3 AI2 status	**Inactive [0]**	general	U8	1	P	-
0x2652:092	Analog input configuration: X3.4 IOL4 AI1 source value	- (Read only)	general	S32	1	-	r
0x2652:093	Analog input configuration: X3.4 IOL4 AI1 target address	**0**	general	U32	1	P	-
0x2652:094	Analog input configuration: X3.4 IOL4 AI1 scaled value	- (Read only)	general	S32	1	-	t
0x2652:095	Analog input configuration: X3.4 IOL4 AI1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:096	Analog input configuration: X3.4 IOL4 AI2 bits input	**16**	general	U8	1	P	-
0x2652:097	Analog input configuration: X3.4 IOL4 AI1 scaling #A1min	**0**	general	S32	1	P	-
0x2652:098	Analog input configuration: X3.4 IOL4 AI1 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:099	Analog input configuration: X3.4 IOL4 AI1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:100	Analog input configuration: X3.4 IOL4 AI1 bits output	**16**	general	U8	1	P	-
0x2652:101	Analog input configuration: X3.4 IOL4 AI1 scaling #B1min	**0**	general	S32	1	P	-
0x2652:102	Analog input configuration: X3.4 IOL4 AI1 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:105	Analog input configuration: X3.4 IOL4 AI1 status	**Inactive [0]**	general	U8	1	P	-
0x2652:107	Analog input configuration: X3.4 IOL4 AI2 source value	- (Read only)	general	S32	1	-	r
0x2652:108	Analog input configuration: X3.4 IOL4 AI2 target address	**0**	general	U32	1	P	-
0x2652:109	Analog input configuration: X3.4 IOL4 AI2 scaled value	- (Read only)	general	S32	1	-	t
0x2652:110	Analog input configuration: X3.4 IOL4 AI2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2652:111	Analog input configuration: X3.4 IOL4 AI2 bits input	**16**	general	U8	1	P	-
0x2652:112	Analog input configuration: X3.4 IOL4 AI2 scaling #A1min	**0**	general	S32	1	P	-
0x2652:113	Analog input configuration: X3.4 IOL4 AI2 scaling #A2max	**65535**	general	S32	1	P	-
0x2652:114	Analog input configuration: X3.4 IOL4 AI2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2652:115	Analog input configuration: X3.4 IOL4 AI2 bits output	**16**	general	U8	1	P	-

* Default setting dependent on the model.

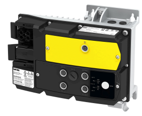


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2652:116	Analog input configuration: X3.4 IOL4 AI2 scaling #B1min	**0**	general	S32	1	P	-
0x2652:117	Analog input configuration: X3.4 IOL4 AI2 scaling #B2max	**65535**	general	S32	1	P	-
0x2652:120	Analog input configuration: X3.4 IOL4 AI2 status	**Inactive [0]**	general	U8	1	P	-
0x2653:001	Analog output configuration: X3.1 IOL1 AO1 source address	**0**	general	U32	1	P	-
0x2653:002	Analog output configuration: X3.1 IOL1 AO1 source value	- (Read only)	general	S32	1	-	r
0x2653:004	Analog output configuration: X3.1 IOL1 AO1 scaled value	- (Read only)	general	S32	1	-	t
0x2653:005	Analog output configuration: X3.1 IOL1 AO1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:006	Analog output configuration: X3.1 IOL1 AO1 bits input	**16**	general	U8	1	P	-
0x2653:007	Analog output configuration: X3.1 IOL1 AO1 scaling #A1min	**0**	general	S32	1	P	-
0x2653:008	Analog output configuration: X3.1 IOL1 AO1 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:009	Analog output configuration: X3.1 IOL1 AO1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:010	Analog output configuration: X3.1 IOL1 AO1 bits output	**16**	general	U8	1	P	-
0x2653:011	Analog output configuration: X3.1 IOL1 AO1 scaling #B1min	**0**	general	S32	1	P	-
0x2653:012	Analog output configuration: X3.1 IOL1 AO1 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:015	Analog output configuration: X3.1 IOL1 AO1 status	**Inactive [0]**	general	U8	1	P	-
0x2653:016	Analog output configuration: X3.1 IOL1 AO2 source address	**0**	general	U32	1	P	-
0x2653:017	Analog output configuration: X3.1 IOL1 AO2 source value	- (Read only)	general	S32	1	-	r
0x2653:019	Analog output configuration: X3.1 IOL1 AO2 scaled value	- (Read only)	general	S32	1	-	t
0x2653:020	Analog output configuration: X3.1 IOL1 AO2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:021	Analog output configuration: X3.1 IOL1 AO2 bits input	**16**	general	U8	1	P	-
0x2653:022	Analog output configuration: X3.1 IOL1 AO2 scaling #A1min	**0**	general	S32	1	P	-
0x2653:023	Analog output configuration: X3.1 IOL1 AO2 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:024	Analog output configuration: X3.1 IOL1 AO2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:025	Analog output configuration: X3.1 IOL1 AO2 bits output	**16**	general	U8	1	P	-
0x2653:026	Analog output configuration: X3.1 IOL1 AO2 scaling #B1min	**0**	general	S32	1	P	-
0x2653:027	Analog output configuration: X3.1 IOL1 AO2 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:030	Analog output configuration: X3.1 IOL1 AO2 status	**Inactive [0]**	general	U8	1	P	-
0x2653:031	Analog output configuration: X3.2 IOL2 AO1 source address	**0**	general	U32	1	P	-
0x2653:032	Analog output configuration: X3.2 IOL2 AO1 source value	- (Read only)	general	S32	1	-	r
0x2653:034	Analog output configuration: X3.2 IOL2 AO1 scaled value	- (Read only)	general	S32	1	-	t
0x2653:035	Analog output configuration: X3.2 IOL2 AO1 data type input	**Unsigned [1]**	general	U8	1	P	-
* Default setting dependent on the model.							

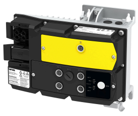


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2653:036	Analog output configuration: X3.2 IOL2 AO1 bits input	**16**	general	U8	1	P	-
0x2653:037	Analog output configuration: X3.2 IOL2 AO1 scaling #A1min	**0**	general	S32	1	P	-
0x2653:038	Analog output configuration: X3.2 IOL2 AO1 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:039	Analog output configuration: X3.2 IOL2 AO1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:040	Analog output configuration: X3.2 IOL2 AO1 bits output	**16**	general	U8	1	P	-
0x2653:041	Analog output configuration: X3.2 IOL2 AO1 scaling #B1min	**0**	general	S32	1	P	-
0x2653:042	Analog output configuration: X3.2 IOL2 AO1 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:045	Analog output configuration: X3.2 IOL2 AO1 status	**Inactive [0]**	general	U8	1	P	-
0x2653:046	Analog output configuration: X3.2 IOL2 AO2 source address	**0**	general	U32	1	P	-
0x2653:047	Analog output configuration: X3.2 IOL2 AO2 source value	- (Read only)	general	S32	1	-	r
0x2653:049	Analog output configuration: X3.2 IOL2 AO2 scaled value	- (Read only)	general	S32	1	-	t
0x2653:050	Analog output configuration: X3.2 IOL2 AO2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:051	Analog output configuration: X3.2 IOL2 AO2 bits input	**16**	general	U8	1	P	-
0x2653:052	Analog output configuration: X3.2 IOL2 AO2 scaling #A1min	**0**	general	S32	1	P	-
0x2653:053	Analog output configuration: X3.2 IOL2 AO2 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:054	Analog output configuration: X3.2 IOL2 AO2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:055	Analog output configuration: X3.2 IOL2 AO2 bits output	**16**	general	U8	1	P	-
0x2653:056	Analog output configuration: X3.2 IOL2 AO2 scaling #B1min	**0**	general	S32	1	P	-
0x2653:057	Analog output configuration: X3.2 IOL2 AO2 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:060	Analog output configuration: X3.2 IOL2 AO2 status	**Inactive [0]**	general	U8	1	P	-
0x2653:061	Analog output configuration: X3.3 IOL3 AO1 source address	**0**	general	U32	1	P	-
0x2653:062	Analog output configuration: X3.3 IOL3 AO1 source value	- (Read only)	general	S32	1	-	r
0x2653:064	Analog output configuration: X3.3 IOL3 AO1 scaled value	- (Read only)	general	S32	1	-	t
0x2653:065	Analog output configuration: X3.3 IOL3 AO1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:066	Analog output configuration: X3.3 IOL3 AO1 bits input	**16**	general	U8	1	P	-
0x2653:067	Analog output configuration: X3.3 IOL3 AO1 scaling #A1min	**0**	general	S32	1	P	-
0x2653:068	Analog output configuration: X3.3 IOL3 AO1 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:069	Analog output configuration: X3.3 IOL3 AO1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:070	Analog output configuration: X3.3 IOL3 AO1 bits output	**16**	general	U8	1	P	-
0x2653:071	Analog output configuration: X3.3 IOL3 AO1 scaling #B1min	**0**	general	S32	1	P	-
0x2653:072	Analog output configuration: X3.3 IOL3 AO1 scaling #B2max	**65535**	general	S32	1	P	-

* Default setting dependent on the model.

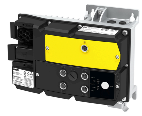


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2653:075	Analog output configuration: X3.3 IOL3 AO1 status	**Inactive [0]**	general	U8	1	P	-
0x2653:076	Analog output configuration: X3.3 IOL3 AO2 source address	**0**	general	U32	1	P	-
0x2653:077	Analog output configuration: X3.3 IOL3 AO2 source value	- (Read only)	general	S32	1	-	r
0x2653:079	Analog output configuration: X3.3 IOL3 AO2 scaled value	- (Read only)	general	S32	1	-	t
0x2653:080	Analog output configuration: X3.3 IOL3 AO2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:081	Analog output configuration: X3.3 IOL3 AO2 bits input	**16**	general	U8	1	P	-
0x2653:082	Analog output configuration: X3.3 IOL3 AO2 scaling #A1min	**0**	general	S32	1	P	-
0x2653:083	Analog output configuration: X3.3 IOL3 AO2 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:084	Analog output configuration: X3.3 IOL3 AO2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:085	Analog output configuration: X3.3 IOL3 AO2 bits output	**16**	general	U8	1	P	-
0x2653:086	Analog output configuration: X3.3 IOL3 AO2 scaling #B1min	**0**	general	S32	1	P	-
0x2653:087	Analog output configuration: X3.3 IOL3 AO2 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:090	Analog output configuration: X3.3 IOL3 AO2 status	**Inactive [0]**	general	U8	1	P	-
0x2653:091	Analog output configuration: X3.4 IOL4 AO1 source address	**0**	general	U32	1	P	-
0x2653:092	Analog output configuration: X3.4 IOL4 AO1 source value	- (Read only)	general	S32	1	-	r
0x2653:094	Analog output configuration: X3.4 IOL4 AO1 scaled value	- (Read only)	general	S32	1	-	t
0x2653:095	Analog output configuration: X3.4 IOL4 AO1 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:096	Analog output configuration: X3.4 IOL4 AO1 bits input	**16**	general	U8	1	P	-
0x2653:097	Analog output configuration: X3.4 IOL4 AO1 scaling #A1min	**0**	general	S32	1	P	-
0x2653:098	Analog output configuration: X3.4 IOL4 AO1 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:099	Analog output configuration: X3.4 IOL4 AO1 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:100	Analog output configuration: X3.4 IOL4 AO1 bits output	**16**	general	U8	1	P	-
0x2653:101	Analog output configuration: X3.4 IOL4 AO1 scaling #B1min	**0**	general	S32	1	P	-
0x2653:102	Analog output configuration: X3.4 IOL4 AO1 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:105	Analog output configuration: X3.4 IOL4 AO1 status	**Inactive [0]**	general	U8	1	P	-
0x2653:106	Analog output configuration: X3.4 IOL4 AO2 source address	**0**	general	U32	1	P	-
0x2653:107	Analog output configuration: X3.4 IOL4 AO2 source value	- (Read only)	general	S32	1	-	r
0x2653:109	Analog output configuration: X3.4 IOL4 AO2 scaled value	- (Read only)	general	S32	1	-	t
0x2653:110	Analog output configuration: X3.4 IOL4 AO2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2653:111	Analog output configuration: X3.4 IOL4 AO2 bits input	**16**	general	U8	1	P	-
0x2653:112	Analog output configuration: X3.4 IOL4 AO2 scaling #A1min	**0**	general	S32	1	P	-
* Default setting dependent on the model.							

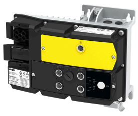


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2653:113	Analog output configuration: X3.4 IOL4 AO2 scaling #A2max	**65535**	general	S32	1	P	-
0x2653:114	Analog output configuration: X3.4 IOL4 AO2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2653:115	Analog output configuration: X3.4 IOL4 AO2 bits output	**16**	general	U8	1	P	-
0x2653:116	Analog output configuration: X3.4 IOL4 AO2 scaling #B1min	**0**	general	S32	1	P	-
0x2653:117	Analog output configuration: X3.4 IOL4 AO2 scaling #B2max	**65535**	general	S32	1	P	-
0x2653:120	Analog output configuration: X3.4 IOL4 AO2 status	**Inactive [0]**	general	U8	1	P	-
0x2654:001	Analog signal scaling: Scaling1 source address	**641859872**	general	U32	1	P	-
0x2654:002	Analog signal scaling: Scaling1 source value	- (Read only)	general	S32	1	-	r
0x2654:003	Analog signal scaling: Scaling1 target address	**0**	general	U32	1	P	-
0x2654:004	Analog signal scaling: Scaling1 scaled value	- (Read only)	general	S32	1	-	t
0x2654:005	Analog signal scaling: Scaling1 data type input	**Signed [0]**	general	U8	1	P	-
0x2654:006	Analog signal scaling: Scaling1 bits input	**32**	general	U8	1	P	-
0x2654:007	Analog signal scaling: Scaling1 #A1min	**0**	general	S32	1	P	-
0x2654:008	Analog signal scaling: Scaling1 #A2min	**65535**	general	S32	1	P	-
0x2654:009	Analog signal scaling: Scaling1 data type output	**Signed [0]**	general	U8	1	P	-
0x2654:010	Analog signal scaling: Scaling1 bits output	**32**	general	U8	1	P	-
0x2654:011	Analog signal scaling: Scaling1 #B1min	**0**	general	S32	1	P	-
0x2654:012	Analog signal scaling: Scaling1 #B2min	**65535**	general	S32	1	P	-
0x2654:015	Analog signal scaling: Scaling1 status	**Inactive [0]**	general	U8	1	P	-
0x2654:016	Analog signal scaling: Scaling2 source address	**0**	general	U32	1	P	-
0x2654:017	Analog signal scaling: Scaling2 source value	- (Read only)	general	S32	1	-	r
0x2654:018	Analog signal scaling: Scaling2 target address	**0**	general	U32	1	P	-
0x2654:019	Analog signal scaling: Scaling2 scaled value	- (Read only)	general	S32	1	-	t
0x2654:020	Analog signal scaling: Scaling2 data type input	**Unsigned [1]**	general	U8	1	P	-
0x2654:021	Analog signal scaling: Scaling2 bits input	**16**	general	U8	1	P	-
0x2654:022	Analog signal scaling: Scaling2 #A1min	**0**	general	S32	1	P	-
0x2654:023	Analog signal scaling: Scaling2 #A2min	**65535**	general	S32	1	P	-
0x2654:024	Analog signal scaling: Scaling2 data type output	**Unsigned [1]**	general	U8	1	P	-
0x2654:025	Analog signal scaling: Scaling2 bits output	**16**	general	U8	1	P	-
0x2654:026	Analog signal scaling: Scaling2 #B1min	**0**	general	S32	1	P	-
0x2654:027	Analog signal scaling: Scaling2 #B2min	**65535**	general	S32	1	P	-
0x2654:030	Analog signal scaling: Scaling2 status	**Inactive [0]**	general	U8	1	P	-
0x2820:001	Holding brake control: Brake mode	**Off [2]**	general	U8	1	PC	r
0x2820:002	Holding brake control: Brake closing time	**100 ms**	general	U16	1	P	-
0x2820:003	Holding brake control: Brake opening time	**100 ms**	general	U16	1	P	-
0x2820:007	Holding brake control: Brake closing threshold	**0.2 Hz**	general	U16	10	P	-
0x2820:008	Holding brake control: Brake holding load	**0.0 %**	general	S16	10	PC	-
0x2820:012	Holding brake control: Closing threshold delay	**0 ms**	general	U16	1	P	-
0x2820:013	Holding brake control: Holding load ramptime	**0 ms**	general	U16	1	PC	-
0x2820:015	Holding brake control: Brake status	- (Read only)	general	U8	1	O	-
0x2820:023	Holding brake control: Configuration output signal	**External digital output [0]**	general	U8	1	P	-
0x2820:024	Holding brake control: Rated voltage	**180 VDC [4]**	general	U8	1	PC	-
0x2822:001	Axis commands: Enable inverter	**Inverter inhibited [0]**	general	U8	1	X	-
0x2822:002	Axis commands: Activate quick stop	**Off / ready [0]**	general	U8	1	X	-
0x2822:003	Axis commands: Reset error	**Off / ready [0]**	general	U8	1	X	-
0x2822:004	Axis commands: Identify motor data (energized)	**0**	MCTRL	U8	1	-	-
0x2822:005	Axis commands: Calibrate motor data (non-energized)	**0**	MCTRL	U8	1	-	-
0x2822:019	Axis commands: Calculate Imax controller parameter	**0**	MCTRL	U8	1	-	-

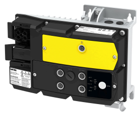
* Default setting dependent on the model.



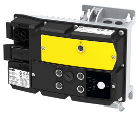
Address	Name	Default setting	Category	Data type	Factor	A	M
0x2826	Time-out for error response	**6.0 s**	general	U32	10	P	-
0x282A:001	Status words: Cause of disable	- (Read only)	general	U32	1	O	-
0x282A:002	Status words: Cause of quick stop	- (Read only)	general	U16	1	O	-
0x282A:003	Status words: Cause of stop	- (Read only)	general	U16	1	O	-
0x282A:004	Status words: Extended status word	- (Read only)	general	U16	1	O	t
0x282A:005	Status words: Device status	- (Read only)	general	U8	1	O	t
0x282B:001	Inverter diagnostics: Active control source	- (Read only)	general	U8	1	O	t
0x282B:002	Inverter diagnostics: Active setpoint source	- (Read only)	general	U8	1	O	t
0x282B:004	Inverter diagnostics: Active drive mode	- (Read only)	general	U8	1	O	t
0x282B:005	Inverter diagnostics: Most recently used control register	- (Read only)	general	U32	1	OH	-
0x282B:006	Inverter diagnostics: Most recently used setpoint register	- (Read only)	general	U32	1	OH	-
0x282B:007	Inverter diagnostics: Default frequency setpoint	x.x Hz (Read only)	general	S16	10	-	-
0x282B:008	Inverter diagnostics: Preset frequency setpoint	x.x Hz (Read only)	general	S16	10	-	-
0x282B:009	Inverter diagnostics: Actual frequency setpoint	x.x Hz (Read only)	general	S16	10	-	-
0x282B:010	Inverter diagnostics: Default PID setpoint	x.xx PID unit (Read only)	general	S16	100	-	-
0x282B:011	Inverter diagnostics: Preset PID setpoint	x.xx PID unit (Read only)	general	S16	100	-	-
0x282B:012	Inverter diagnostics: Default torque setpoint	x.x % (Read only)	general	S16	10	-	-
0x282B:013	Inverter diagnostics: Preset torque setpoint	x.x % (Read only)	general	S16	10	-	-
0x2831	Inverter status word	- (Read only)	MCTRL	U16	1	O	t
0x2833	Inverter status word 2	- (Read only)	MCTRL	U16	1	O	t
0x2838:001	Start/stop configuration: Start method	**Normal [0]**	general	U8	1	P	-
0x2838:002	Start/stop configuration: Start at power-up	**Off [0]**	general	U8	1	P	-
0x2838:003	Start/stop configuration: Stop method	**Standard ramp [1]**	general	U8	1	P	-
0x2839:002	Fault configuration: Restart delay	**3.0 s**	general	U16	10	P	-
0x2839:003	Fault configuration: Number of restart attempts	**5**	general	U8	1	P	-
0x2839:004	Fault configuration: Trouble counter reset time	**40.0 s**	general	U16	10	P	-
0x2839:005	Fault configuration: Trouble counter	- (Read only)	general	U8	1	-	-
0x2839:006	Fault configuration: Fault handling in case of state change	**Reset fault [0]**	general	U8	1	P	-
0x283A	Limitation of rotation	**Both rotational directions [1]**	general	U8	1	P	-
0x2859:001	Network monitoring: Watchdog elapsed	**Trouble [16]**	general	U8	1	P	-
0x2859:003	Network monitoring: Invalid configuration	**Trouble [16]**	general	U8	1	P	-
0x2859:004	Network monitoring: Initialisation error	**Trouble [16]**	general	U8	1	P	-
0x2859:005	Network monitoring: Invalid process data	**Trouble [16]**	general	U8	1	P	-
0x2859:006	Network monitoring: Time-out explicit message	**Warning [12]**	general	U8	1	P	-
0x2859:007	Network monitoring: Timeout communication	**Warning [12]**	general	U8	1	P	-
0x2859:008	Network monitoring: Fault reaction by time-out Master	**Fault [23]**	general	U8	1	P	-
0x2859:009	Network monitoring: Fault reaction by time-out Keep alive	**Fault [23]**	general	U8	1	P	-
0x285A:001	Diagnostic configuration: Alarm suppression	**0**	general	U16	1	P	-
0x285C:001	Alarm supression: Entry 1	**0x00000000**	general	U32	1	PH	-
0x285C:002	Alarm supression: Entry 2	**0x00000000**	general	U32	1	PH	-
0x285C:003	Alarm supression: Entry 3	**0x00000000**	general	U32	1	PH	-
0x285C:004	Alarm supression: Entry 4	**0x00000000**	general	U32	1	PH	-
0x285C:005	Alarm supression: Entry 5	**0x00000000**	general	U32	1	PH	-
0x285C:006	Alarm supression: Entry 6	**0x00000000**	general	U32	1	PH	-
0x285C:007	Alarm supression: Entry 7	**0x00000000**	general	U32	1	PH	-
0x285C:008	Alarm supression: Entry 8	**0x00000000**	general	U32	1	PH	-
0x285C:009	Alarm supression: Entry 9	**0x00000000**	general	U32	1	PH	-
0x285C:010	Alarm supression: Entry 10	**0x00000000**	general	U32	1	PH	-
0x2860:001	Frequency control: Default setpoint source	**Frequency preset 1 [11]**	general	U8	1	P	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x2860:002	PID control: Default setpoint source	**PID preset 1 [11]**	general	U8	1	P	-
0x2860:003	Torque control: Default setpoint source	**Torque preset 1 [11]**	general	U8	1	P	-
0x2900:001	Speed controller settings: Gain	**0.00033 Nm/rpm**	MCTRL	U32	100000	P	-
0x2900:002	Speed controller settings: Reset time	**17.6 ms**	MCTRL	U16	10	P	-
0x2904	Actual speed filter time	**2.0 ms**	MCTRL	U16	10	P	-
0x2910:001	Inertia settings: Motor moment of inertia	**3.70 kg cm²**	MCTRL	U32	100	P	-
0x2910:002	Inertia settings: Scaled load inertia	**0.00 kg cm²**	MCTRL	U32	100	P	-
0x2910:003	Inertia settings: Coupling	**With backlash [2]**	MCTRL	U8	1	P	-
0x2911:001	Frequency setpoint presets: Preset 1	**20.0 Hz**	general	U16	10	P	-
0x2911:002	Frequency setpoint presets: Preset 2	**40.0 Hz**	general	U16	10	P	-
0x2911:003	Frequency setpoint presets: Preset 3	**50.0 Hz**	general	U16	10	P	-
0x2911:004	Frequency setpoint presets: Preset 4	**0.0 Hz**	general	U16	10	P	-
0x2911:005	Frequency setpoint presets: Preset 5	**0.0 Hz**	general	U16	10	P	-
0x2911:006	Frequency setpoint presets: Preset 6	**0.0 Hz**	general	U16	10	P	-
0x2911:007	Frequency setpoint presets: Preset 7	**0.0 Hz**	general	U16	10	P	-
0x2911:008	Frequency setpoint presets: Preset 8	**0.0 Hz**	general	U16	10	P	-
0x2911:009	Frequency setpoint presets: Preset 9	**0.0 Hz**	general	U16	10	P	-
0x2911:010	Frequency setpoint presets: Preset 10	**0.0 Hz**	general	U16	10	P	-
0x2911:011	Frequency setpoint presets: Preset 11	**0.0 Hz**	general	U16	10	P	-
0x2911:012	Frequency setpoint presets: Preset 12	**0.0 Hz**	general	U16	10	P	-
0x2911:013	Frequency setpoint presets: Preset 13	**0.0 Hz**	general	U16	10	P	-
0x2911:014	Frequency setpoint presets: Preset 14	**0.0 Hz**	general	U16	10	P	-
0x2911:015	Frequency setpoint presets: Preset 15	**0.0 Hz**	general	U16	10	P	-
0x2912:001	Torque setpoint presets: Preset 1	**100.0 %**	general	S16	10	P	-
0x2912:002	Torque setpoint presets: Preset 2	**100.0 %**	general	S16	10	P	-
0x2912:003	Torque setpoint presets: Preset 3	**100.0 %**	general	S16	10	P	-
0x2912:004	Torque setpoint presets: Preset 4	**100.0 %**	general	S16	10	P	-
0x2912:005	Torque setpoint presets: Preset 5	**100.0 %**	general	S16	10	P	-
0x2912:006	Torque setpoint presets: Preset 6	**100.0 %**	general	S16	10	P	-
0x2912:007	Torque setpoint presets: Preset 7	**100.0 %**	general	S16	10	P	-
0x2912:008	Torque setpoint presets: Preset 8	**100.0 %**	general	S16	10	P	-
0x2915	Minimum frequency	**0.0 Hz**	general	U16	10	P	-
0x2916	Maximum frequency	**50.0 Hz**	general	U16	10	P	-
0x291B	Auto-changeover threshold of ramp 2	**0.0 Hz**	general	U16	10	P	-
0x291C	Quick stop deceleration time	**1.0 s**	general	U16	10	P	-
0x291D:001	Ramp times: Acceleration time 1	**5.00 s**	general	U16	100	P	rt
0x291D:002	Ramp times: Deceleration time 1	**5.00 s**	general	U16	100	P	rt
0x291D:003	Ramp times: Acceleration time 2	**5.00 s**	general	U16	100	P	rt
0x291D:004	Ramp times: Deceleration time 2	**5.00 s**	general	U16	100	P	rt
0x291E:001	S-Ramp characteristic: Smoothing factor	**0.0 %**	general	U16	10	P	r
0x291E:002	S-Ramp characteristic: Target window	**1.0 Hz**	general	U16	10	P	-
0x291F:001	Skip frequencies: Skip frequency 1	**0.0 Hz**	general	U16	10	P	-
0x291F:002	Skip frequencies: Skip bandwidth 1	**0.0 Hz**	general	U8	10	P	-
0x291F:003	Skip frequencies: Skip frequency 2	**0.0 Hz**	general	U16	10	P	-
0x291F:004	Skip frequencies: Skip bandwidth 2	**0.0 Hz**	general	U8	10	P	-
0x291F:005	Skip frequencies: Skip frequency 3	**0.0 Hz**	general	U16	10	P	-
0x291F:006	Skip frequencies: Skip bandwidth 3	**0.0 Hz**	general	U8	10	P	-
0x291F:016	Skip frequencies: Status	- (Read only)	general	U16	1	X	-
0x291F:032	Skip frequencies: Input frequency	x.xx Hz (Read only)	general	S32	100	X	-
0x291F:033	Skip frequencies: Output frequency	x.xx Hz (Read only)	general	S32	100	X	-
0x2939	Switching frequency	**0**	general	U8	1	P	-
0x293A	Actual switching frequency	- (Read only)	general	U8	1	O	t
0x2942:001	Current controller parameters: Gain	**148.21 V/A**	MCTRL	U32	100	P	-
0x2942:002	Current controller parameters: Reset time	**3.77 ms**	MCTRL	U32	100	P	-
* Default setting dependent on the model.							

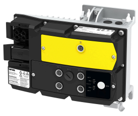


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2942:004	Current controller parameters: d-axis gain	**148.21 V/A**	MCTRL	U32	100	P	-
0x2942:005	Current controller parameters: d-axis reset time	**3.77 ms**	MCTRL	U32	100	P	-
0x2942:006	Current controller parameters: q-axis gain	**148.21 V/A**	MCTRL	U32	100	P	-
0x2942:007	Current controller parameters: q-axis reset time	**3.77 ms**	MCTRL	U32	100	P	-
0x2946:001	Speed limitation: Upper speed limit	**0 rpm**	general	S32	480000 /2^31-1	P	r
0x2946:002	Speed limitation: Lower speed limit	**0 rpm**	general	S32	480000 /2^31-1	P	r
0x2946:003	Speed limitation: Upper speed limit source	**Maximum frequency [0]**	general	U8	1	P	-
0x2946:004	Speed limitation: Lower speed limit source	**(-) Maximum frequency [0]**	general	U8	1	P	-
0x2946:005	Speed limitation: Upper frequency limit	**50.0 Hz**	general	S16	10	P	-
0x2946:006	Speed limitation: Lower frequency limit	**-50.0 Hz**	general	S16	10	P	-
0x2946:007	Speed limitation: Actual upper speed limit	x.x Hz (Read only)	general	S16	10	-	-
0x2946:008	Speed limitation: Actual lower speed limit	x.x Hz (Read only)	general	S16	10	-	-
0x2947:001 ... 0x2947:017	Inverter characteristic: Value y1 ... Value y17	**0.00 V**	MCTRL	U16	100	P	-
0x2948:001	Torque setpoint: Actual torque setpoint	x.x % (Read only)	general	S16	10	O	-
0x2948:002	Torque setpoint: ramp time	**1.0 s**	general	U16	10	P	-
0x2949:001	Torque limit source selection: Positive torque limit source	**Max torque [0]**	general	U8	1	P	-
0x2949:002	Torque limit source selection: Negative torque limit source	**(-) Max torque [0]**	general	U8	1	P	-
0x2949:003	Torque limit source selection: Actual positive torque limit	x.x % (Read only)	general	S16	10	-	-
0x2949:004	Torque limit source selection: Actual negative torque limit	x.x % (Read only)	general	S16	10	-	-
0x29C0:001	Field controller settings: Gain	**165.84 A/Vs**	MCTRL	U32	100	P	-
0x29C0:002	Field controller settings: Reset time	**15.1 ms**	MCTRL	U16	10	P	-
0x29E0:001	Field weakening controller settings: Gain (ASM)	**0.000 Vs/V**	MCTRL	U32	1000	P	-
0x29E0:002	Field weakening controller settings: Reset time (ASM)	**2000.0 ms**	MCTRL	U32	10	P	-
0x29E0:003	Field weakening controller settings: Reset time (PSM)	**40.0 ms**	MCTRL	U32	10	P	-
0x29E1	Field weakening controller Field limitation	**100.00 %**	MCTRL	U16	100	P	-
0x29E2	DC-bus filter time	**25.0 ms**	MCTRL	U16	10	P	-
0x29E3	Motor voltage filter time	**25.0 ms**	MCTRL	U16	10	P	-
0x29E4	Voltage reserve range	**5 %**	MCTRL	U8	1	P	-
0x2B00	V/f characteristic shape	**Linear [0]**	MCTRL	U8	1	PC	-
0x2B01:001	V/f shape data: Base voltage	**400 V**	MCTRL	U16	1	P	-
0x2B01:002	V/f shape data: Base frequency	**50 Hz**	MCTRL	U16	1	P	-
0x2B01:003	V/f shape data: Midpoint voltage	**0 V**	MCTRL	U16	1	P	-
0x2B01:004	V/f shape data: Midpoint frequency	**0 Hz**	MCTRL	U16	1	P	-
0x2B02:001	Frequency grid points (x) user V/f characteristic: x1 = f01	**-50 Hz**	MCTRL	S16	1	P	-
0x2B02:002	Frequency grid points (x) user V/f characteristic: x2 = f02	**-40 Hz**	MCTRL	S16	1	P	-
0x2B02:003	Frequency grid points (x) user V/f characteristic: x3 = f03	**-30 Hz**	MCTRL	S16	1	P	-
0x2B02:004	Frequency grid points (x) user V/f characteristic: x4 = f04	**-20 Hz**	MCTRL	S16	1	P	-
0x2B02:005	Frequency grid points (x) user V/f characteristic: x5 = f05	**-10 Hz**	MCTRL	S16	1	P	-
0x2B02:006	Frequency grid points (x) user V/f characteristic: x6 = f06	**0 Hz**	MCTRL	S16	1	P	-
0x2B02:007	Frequency grid points (x) user V/f characteristic: x7 = f07	**10 Hz**	MCTRL	S16	1	P	-
* Default setting dependent on the model.							

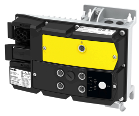


Address	Name	Default setting	Category	Data type	Factor	A	M
0x2B02:008	Frequency grid points (x) user V/f characteristic: x8 = f08	**20 Hz**	MCTRL	S16	1	P	-
0x2B02:009	Frequency grid points (x) user V/f characteristic: x9 = f09	**30 Hz**	MCTRL	S16	1	P	-
0x2B02:010	Frequency grid points (x) user V/f characteristic: x10 = f10	**40 Hz**	MCTRL	S16	1	P	-
0x2B02:011	Frequency grid points (x) user V/f characteristic: x11 = f11	**50 Hz**	MCTRL	S16	1	P	-
0x2B03:001	Voltage grid points (y) user V/f characteristic: y1 = U01 (x = f01)	**400.00 V**	MCTRL	S32	100	P	-
0x2B03:002	Voltage grid points (y) user V/f characteristic: y2 = U02 (x = f02)	**320.00 V**	MCTRL	S32	100	P	-
0x2B03:003	Voltage grid points (y) user V/f characteristic: y3 = U03 (x = f03)	**240.00 V**	MCTRL	S32	100	P	-
0x2B03:004	Voltage grid points (y) user V/f characteristic: y4 = U04 (x = f04)	**160.00 V**	MCTRL	S32	100	P	-
0x2B03:005	Voltage grid points (y) user V/f characteristic: y5 = U05 (x = f05)	**80.00 V**	MCTRL	S32	100	P	-
0x2B03:006	Voltage grid points (y) user V/f characteristic: y6 = U06 (x = f06)	**0.00 V**	MCTRL	S32	100	P	-
0x2B03:007	Voltage grid points (y) user V/f characteristic: y7 = U07 (x = f07)	**80.00 V**	MCTRL	S32	100	P	-
0x2B03:008	Voltage grid points (y) user V/f characteristic: y8 = U08 (x = f08)	**160.00 V**	MCTRL	S32	100	P	-
0x2B03:009	Voltage grid points (y) user V/f characteristic: y9 = U09 (x = f09)	**240.00 V**	MCTRL	S32	100	P	-
0x2B03:010	Voltage grid points (y) user V/f characteristic: y10 = U10 (x = f10)	**320.00 V**	MCTRL	S32	100	P	-
0x2B03:011	Voltage grid points (y) user V/f characteristic: y11 = U11 (x = f11)	**400.00 V**	MCTRL	S32	100	P	-
0x2B08:001	V/f Imax controller: Gain	**0.284 Hz/A**	MCTRL	U32	1000	P	-
0x2B08:002	V/f Imax controller: Reset time	**2.3 ms**	MCTRL	U32	10	P	-
0x2B09:001	Slip compensation: Gain	**100.00 %**	MCTRL	S16	100	P	-
0x2B09:002	Slip compensation: Filter time	**100 ms**	MCTRL	U16	1	P	-
0x2B0A:001	Oscillation damping: Gain	**150 %**	MCTRL	S16	1	P	-
0x2B0A:002	Oscillation damping: Filter time	**30 ms**	MCTRL	U16	1	P	-
0x2B0B	Ramp generator frequency	x.x Hz (Read only)	MCTRL	S16	10	O	t
0x2B0C	Override field weakening	**-40.0 Hz**	MCTRL	S16	10	P	-
0x2B0D:001	VFC-ECO: Minimum voltage	**20 %**	MCTRL	S16	1	P	-
0x2B0D:006	VFC-ECO: Cos phi actual value	- (Read only)	MCTRL	S16	100	-	t
0x2B0E	Frequency setpoint	x.x Hz (Read only)	MCTRL	S16	10	O	t
0x2B0F	Output frequency motor	x.x Hz (Read only)	MCTRL	S16	10	O	t
0x2B10:001	V/f torque limitation: Gain	**0.00 %**	MCTRL	U16	100	P	-
0x2B12:001	V/f voltage boost: Fixed boost	**2.5 %**	MCTRL	U8	10	P	-
0x2B12:002	V/f voltage boost: Boost at acceleration	**0.0 %**	MCTRL	U8	10	P	-
0x2B13:001	Additive voltage impression: Enable Function	**Disable [0]**	general	U8	1	P	-
0x2B13:002	Additive voltage impression: Setpoint source	**Network [3]**	general	U8	1	P	-
0x2B13:003	Additive voltage impression: Actual voltage	x V (Read only)	general	S16	1	-	-
0x2B13:004	Additive voltage impression: Ramp time	**0.0 s**	general	U16	10	P	-
0x2B14:001	Slip controller: Gain	**0.100**	MCTRL	U16	1000	P	-
0x2B14:002	Slip controller: Reset time	**100.0 ms**	MCTRL	U16	10	P	-
0x2B14:003	Slip controller: Frequency limitation	**10.00 Hz**	MCTRL	U16	100	P	-
0x2B40:001	SLVC: Gain	**0.2686 Hz/A**	MCTRL	U32	10000	P	-
0x2B40:002	SLVC: Reset time	**2.3 ms**	MCTRL	U32	10	P	-
0x2B40:003	SLVC: Q-Feedforward	**0.00**	MCTRL	U32	100	P	-
0x2B40:004	SLVC: D-Feedforward	**0.00**	MCTRL	U32	100	P	-
0x2B84:001	DC braking: Current	**0.0 %**	general	U16	10	P	-
* Default setting dependent on the model.							

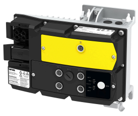
Address	Name	Default setting	Category	Data type	Factor	A	M
0x2B84:002	DC braking: Automatic hold time	**0.0 s**	general	U16	10	P	-
0x2B84:003	DC braking: Automatic operating threshold	**0.0 Hz**	general	U16	10	P	-
0x2B84:004	DC braking: Demagnetization time	**100 %**	general	U8	1	P	-
0x2B84:005	DC braking: Default demagnetization time	x ms (Read only)	general	U16	1	-	-
0x2B84:006	DC braking: Inverter disable	**Disabled [0]**	general	U8	1	P	-
0x2BA1:001	Flying restart circuit: Current	**30 %**	MCTRL	U16	1	P	-
0x2BA1:002	Flying restart circuit: Start frequency	**20.0 Hz**	MCTRL	S16	10	P	-
0x2BA1:003	Flying restart circuit: Restart time	**5911 ms**	MCTRL	U16	1	P	-
0x2BA1:008	Flying restart circuit: Flying restart frequency	x.x Hz (Read only)	MCTRL	S16	10	O	t
0x2C00	Motor control mode	**V/f characteristic control (VFC open loop) [6]**	MCTRL	U8	1	PC	-
0x2C01:001	Motor parameters: Number of pole pairs	- (Read only)	MCTRL	U8	1	-	-
0x2C01:002	Motor parameters: Stator resistance	**13.5000 Ω**	MCTRL	U32	10000	P	-
0x2C01:003	Motor parameters: Stator leakage inductance	**51.000 mH**	MCTRL	U32	1000	P	-
0x2C01:004	Motor parameters: Rated speed	**1450 rpm**	MCTRL	U16	1	P	-
0x2C01:005	Motor parameters: Rated frequency	**50.0 Hz**	MCTRL	U16	10	P	-
0x2C01:006	Motor parameters: Rated power	**0.25 kW**	MCTRL	U16	100	P	-
0x2C01:007	Motor parameters: Rated voltage	**230 V**	MCTRL	U16	1	P	-
0x2C01:008	Motor parameters: Cosine phi	**0.80**	MCTRL	U16	100	P	-
0x2C01:010	Motor parameters: Motor name	**"Default Motor"**	MCTRL	STRING[25]		P	-
0x2C02:001	Motor parameter (ASM): Rotor resistance	**8.8944 Ω**	MCTRL	U32	10000	P	-
0x2C02:002	Motor parameter (ASM): Mutual inductance	**381.9 mH**	MCTRL	U32	10	P	-
0x2C02:003	Motor parameter (ASM): Magnetising current	**0.96 A**	MCTRL	U16	100	P	-
0x2C02:004	Motor parameter (ASM): Slip frequency	x.x Hz (Read only)	MCTRL	U16	10	O	-
0x2C03:001	Motor parameter (PSM): Back EMF constant	**41.8 V/1000rpm**	MCTRL	U32	10	P	-
0x2C03:005	Motor parameter (PSM): D-axis inductance Ld	**23.566 mH**	MCTRL	U32	1000	P	-
0x2C03:006	Motor parameter (PSM): Q-axis inductance Lq	**23.566 mH**	MCTRL	U32	1000	P	-
0x2C10:001	Low speed range: HF amplitude	**50.0 V**	MCTRL	U16	10	P	-
0x2C10:008	Low speed range: HF injection range	**6.0 %**	MCTRL	U16	10	P	-
0x2C11:001	High speed range: Lower limit	**10 %**	MCTRL	U16	1	P	-
0x2C11:006	High speed range: Stall monitoring limit	**50 %**	MCTRL	U16	1	P	-
0x2C12:001	SM low speed range: Acceleration current	**70 %**	MCTRL	U16	1	P	-
0x2C12:002	SM low speed range: Standstill current	**30 %**	MCTRL	U16	1	P	-
0x2C13	SLSM-PSM low speed method	**0**	MCTRL	U8	1	PC	-
0x2C42:001	Encoder settings: Increments/revolution	**128**	general	U32	1	PC	-
0x2C42:006	Encoder settings: Actual velocity	x rpm (Read only)	general	S32	1	O	-
0x2C42:007	Encoder settings: Status	- (Read only)	general	U32	1	O	-
0x2C45	Motor feedback error response	**Warning [12]**	general	U8	1	P	-
0x2C49:001	Position counter: Signal source	**Disbled [0]**	general	U8	1	P	-
0x2C49:002	Position counter: Reset mode	**Reset by rising edge [0]**	general	U8	1	P	-
0x2C49:003	Position counter: Actual position	- (Read only)	general	U32	1	H	t
0x2C49:004	Position counter: External position	- (Read only)	general	U32	1	H	r
0x2C63:001	PPI without movement: Execution	**After each enable [2]**	MCTRL	U8	1	PC	-
0x2C63:002	PPI without movement: Current adjust factor	**100 %**	MCTRL	U16	1	PC	-
0x2D40:002	Device utilisation ixt: Power unit warning threshold	**95 %**	general	U16	1	P	-
0x2D40:004	Device utilisation ixt: Device actual utilisation	x % (Read only)	general	U16	1	O	t
0x2D40:005	Device utilisation ixt: Error response	**Fault [23]**	general	U8	1	P	-
0x2D44:001	Overspeed monitoring: Threshold	**8000 rpm**	MCTRL	U16	1	P	-
0x2D44:002	Overspeed monitoring: Response	**Fault [23]**	general	U8	1	P	-
0x2D45:001	Motor phase failure detection: Response - Motor phase 1	**No response [0]**	general	U8	1	P	-
0x2D45:002	Motor phase failure detection: Current threshold	**5.0 %**	MCTRL	U8	10	P	-
0x2D45:003	Motor phase failure detection: Voltage threshold	**10.0 V**	MCTRL	U16	10	P	-
0x2D46:001	Overcurrent monitoring: Threshold	**6.8 A**	MCTRL	U16	10	P	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x2D46:002	Overcurrent monitoring: Response	**Fault [23]**	general	U8	1	P	-
0x2D49:002	Motor temperature monitoring: Response	**Fault [23]**	general	U8	1	P	-
0x2D4B:001	Motor overload monitoring (i²xt): Maximum utilisation [60 s]	**150 %**	MCTRL	U16	1	P	-
0x2D4B:002	Motor overload monitoring (i²xt): Speed compensation	**On [0]**	MCTRL	U8	1	P	-
0x2D4B:003	Motor overload monitoring (i²xt): Response	**Fault [23]**	general	U8	1	P	-
0x2D4B:005	Motor overload monitoring (i²xt): Thermal load	- (Read only)	MCTRL	U16	1	-	-
0x2D4F	Motor utilisation (i²xt)	x % (Read only)	MCTRL	U16	1	O	t
0x2D67:001	Maximum torque monitoring: Response	**No response [0]**	general	U8	1	P	-
0x2D67:002	Maximum torque monitoring: Triggering delay	**0.000 s**	MCTRL	U16	1000	P	-
0x2D81:001	Life-diagnosis: Operating time	x s (Read only)	general	U32	1	-	-
0x2D81:002	Life-diagnosis: Power-on time	x s (Read only)	general	U32	1	-	-
0x2D81:003	Life-diagnosis: Control unit operating time	x ns (Read only)	general	U64	1	-	-
0x2D81:004	Life-diagnosis: Main switching cycles	- (Read only)	general	U32	1	-	-
0x2D81:006	Life-diagnosis: Short-circuit counter	- (Read only)	general	U32	1	-	-
0x2D81:007	Life-diagnosis: Earth fault counter	- (Read only)	general	U32	1	-	-
0x2D81:008	Life-diagnosis: Clamp active	- (Read only)	general	U32	1	-	-
0x2D81:009	Life-diagnosis: Fan operating time	x s (Read only)	general	U32	1	-	-
0x2D82	Motor actual voltage (Veff)	x.x V (Read only)	MCTRL	U32	10	O	t
0x2D83:002	Motor-Phasenströme: Phase U current	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2D83:003	Motor-Phasenströme: Phase V current	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2D83:004	Motor-Phasenströme: Phase W current	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2D84:001	Heatsink temperature: Heatsink temperature	x.x °C (Read only)	general	S16	10	O	t
0x2D84:002	Heatsink temperature: Warning threshold	**80.0 °C**	general	S16	10	P	-
0x2D84:003	Heatsink temperature: Fan on threshold	**0.0 °C**	general	S16	10	P	-
0x2D84:004	Heatsink temperature: Fan off threshold	**0.0 °C**	general	S16	10	P	-
0x2D87	DC-bus voltage	x V (Read only)	MCTRL	U16	1	O	t
0x2D88	Motor current	x.x A (Read only)	MCTRL	S16	10	O	t
0x2D89	Motor voltage	x VAC (Read only)	MCTRL	U16	1	O	t
0x2DA2:001	Output power: Effective power	x.xxx kW (Read only)	MCTRL	S32	1000	O	t
0x2DA2:002	Output power: Apparent power	x.xxx kVA (Read only)	MCTRL	S32	1000	O	t
0x2DA3:001	Output energy: Motor	x.xx kWh (Read only)	MCTRL	S32	100	O	t
0x2DA3:002	Output energy: Generator	x.xx kWh (Read only)	MCTRL	S32	100	O	t
0x2DD1:001	Motor currents: Actual D-current (id)	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2DD1:002	Motor currents: Actual Q-current (iq)	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2DD1:003	Motor currents: Setpoint D-current (id)	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2DD1:004	Motor currents: Setpoint Q-current (iq)	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2DD1:005	Motor currents: Motor current (Ieff)	x.xx A (Read only)	MCTRL	S32	100	O	t
0x2DD3:001	Speed setpoints: Speed setpoint	x rpm (Read only)	MCTRL	S32	1	O	t
0x2DD3:003	Speed setpoints: Speed setpoint limited	x rpm (Read only)	MCTRL	S32	1	O	t
0x2DD4:001	Speed controller output signals: Output signal 1	x.x % (Read only)	MCTRL	S16	10	-	-
0x2DD4:002	Speed controller output signals: Output signal 2	x.x % (Read only)	MCTRL	S16	10	-	t
0x2DD5	Torque setpoint	x.xx Nm (Read only)	MCTRL	S32	100	-	t
0x2DDC	Actual slip value	x.x Hz (Read only)	MCTRL	S16	10	-	t
0x2DDD	Output frequency	x.x Hz (Read only)	MCTRL	S16	10	O	t
0x2DDF:001	Axis information: Rated current	x.xx A (Read only)	MCTRL	U16	100	O	t
0x2DDF:002	Axis information: Maximum current	x.xx A (Read only)	MCTRL	U16	100	O	t
0x4003	MOP starting mode	**Last value [0]**	general	U8	1	P	-
0x4004:001	MOP starting values: Frequency	**0.0 Hz**	general	U16	10	P	-
0x4004:002	MOP starting values: PID value	**0.00 PID unit**	general	S16	100	P	-
0x4004:003	MOP starting values: Torque	**0.0 %**	general	U16	10	P	-
0x4005	Frequency threshold	**0.0 Hz**	MCTRL	U16	10	P	-
0x4006:001	Load loss detection: Threshold	**0.0 %**	MCTRL	U16	10	P	-
* Default setting dependent on the model.							

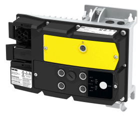


Address	Name	Default setting	Category	Data type	Factor	A	M
0x4006:002	Load loss detection: Delay time	**0.0 s**	MCTRL	U16	10	P	-
0x4006:003	Load loss detection: Error response	**No response [0]**	general	U8	1	P	-
0x4007:001	Heavy load monitoring: Error threshold	**200.0 %**	MCTRL	U16	10	P	-
0x4007:002	Heavy load monitoring: Delay time	**3.0 s**	MCTRL	U16	10	P	-
0x4007:003	Heavy load monitoring: Error response	**No response [0]**	general	U8	1	P	-
0x4008:001	Process input words: NetWordIN1	**0x0000**	general	U16	1	HK	r
0x4008:002	Process input words: NetWordIN2	**0x0000**	general	U16	1	HK	r
0x4008:005	Process input words: NetWordIN5	**0.0 %**	general	S16	10	OK	r
0x4009:001	MOP values saved: Frequency	x.x Hz (Read only)	general	U16	10	-	t
0x4009:002	MOP values saved: PID value	x.xx PID unit (Read only)	general	S16	100	-	t
0x4009:003	MOP values saved: Torque	x.x % (Read only)	general	U16	10	-	t
0x400A:001	Process output words: NetWordOUT1	- (Read only)	general	U16	1	OH	t
0x400B:001	Process input data: AC Drive control word	**0**	general	U16	1	-	r
0x400B:003	Process input data: Network setpoint frequency (0.1)	**0.0 Hz**	general	U16	10	OK	r
0x400B:004	Process input data: Network setpoint speed	**0 rpm**	general	U16	1	OK	r
0x400B:005	Process input data: Network setpoint frequency (0.01)	**0.00 Hz**	general	U16	100	O	r
0x400B:006	Process input data: Velocity mode setpoint	**0.0 Hz**	general	S16	10	OK	r
0x400B:007	Process input data: PID setpoint	**0.00 PID unit**	general	S16	100	OK	r
0x400B:008	Process input data: Torque mode setpoint	**0 Nm**	general	S16	1	OK	r
0x400B:009	Process input data: Torque scaling	**0**	general	S8	1	OK	-
0x400B:010	Process input data: AC Drive mode	- (Read only)	EtherNet/IP	U8	1	OK	-
0x400B:011	Process input data: PID feedback	**0.00 PID unit**	general	S16	100	OK	r
0x400B:013	Process input data: Network frequency setpoint [+/-16384]	**0**	general	S16	1	O	r
0x400C:001	Process output data: AC Drive status word	- (Read only)	general	U16	1	-	t
0x400C:003	Process output data: Frequency (0.1)	x.x Hz (Read only)	MCTRL	U16	10	-	t
0x400C:004	Process output data: Motor speed	x rpm (Read only)	MCTRL	U16	1	-	t
0x400C:005	Process output data: Drive status	- (Read only)	general	U16	1	-	t
0x400C:006	Process output data: Frequency (0.01)	x.xx Hz (Read only)	MCTRL	U16	100	-	t
0x400C:007	Process output data: Torque scaled	- (Read only)	general	S16	1	-	t
0x400C:009	Process output data: Frequency [+/-16384]	- (Read only)	general	S16	1	-	t
0x400E:001	NetWordIN1 function: Bit 0	**Not active [0]**	general	U8	1	PC	-
0x400E:002	NetWordIN1 function: Bit 1	**Not active [0]**	general	U8	1	PC	-
0x400E:003	NetWordIN1 function: Bit 2	**Activate quick stop [3]**	general	U8	1	PC	-
0x400E:004	NetWordIN1 function: Bit 3	**Not active [0]**	general	U8	1	PC	-
0x400E:005	NetWordIN1 function: Bit 4	**Run forward (CW) [8]**	general	U8	1	PC	-
0x400E:006	NetWordIN1 function: Bit 5	**Activate preset (bit 0) [18]**	general	U8	1	PC	-
0x400E:007	NetWordIN1 function: Bit 6	**Activate preset (bit 1) [19]**	general	U8	1	PC	-
0x400E:008	NetWordIN1 function: Bit 7	**Reset error [4]**	general	U8	1	PC	-
0x400E:009	NetWordIN1 function: Bit 8	**Not active [0]**	general	U8	1	PC	-
0x400E:010	NetWordIN1 function: Bit 9	**Activate DC braking [5]**	general	U8	1	PC	-
0x400E:011	NetWordIN1 function: Bit 10	**Not active [0]**	general	U8	1	PC	-
0x400E:012	NetWordIN1 function: Bit 11	**Not active [0]**	general	U8	1	PC	-
0x400E:013	NetWordIN1 function: Bit 12	**Reverse rotational direction [13]**	general	U8	1	PC	-
0x400E:014	NetWordIN1 function: Bit 13	**Not active [0]**	general	U8	1	PC	-
0x400E:015	NetWordIN1 function: Bit 14	**Not active [0]**	general	U8	1	PC	-
0x400E:016	NetWordIN1 function: Bit 15	**Not active [0]**	general	U8	1	PC	-
0x4015:001	Digital input status: Level of digital input 1	- (Read only)	general	U8	1	X	-
0x4015:002	Digital input status: Level of digital input 2	- (Read only)	general	U8	1	X	-
0x4015:003	Digital input status: Level of digital input 3	- (Read only)	general	U8	1	X	-
* Default setting dependent on the model.							



Address	Name	Default setting	Category	Data type	Factor	A	M
0x4015:004	Digital input status: Level of digital input 4	- (Read only)	general	U8	1	X	-
0x4015:005	Digital input status: Level of digital input 5	- (Read only)	general	U8	1	X	-
0x4015:006	Digital input status: Level of digital input 6	- (Read only)	general	U8	1	X	-
0x4015:007	Digital input status: Level of digital input 7	- (Read only)	general	U8	1	X	-
0x4015:008	Digital input status: Level of digital input 8	- (Read only)	general	U8	1	X	-
0x4015:017	Digital input status: Level from digital input 1	- (Read only)	general	U8	1	X	-
0x4015:018	Digital input status: Level from digital input 2	- (Read only)	general	U8	1	X	-
0x4015:019	Digital input status: Level from digital input 3	- (Read only)	general	U8	1	X	-
0x4015:020	Digital input status: Level from digital input 4	- (Read only)	general	U8	1	X	-
0x4015:021	Digital input status: Level from digital input 5	- (Read only)	general	U8	1	X	-
0x4015:022	Digital input status: Level from digital input 6	- (Read only)	general	U8	1	X	-
0x4015:023	Digital input status: Level from digital input 7	- (Read only)	general	U8	1	X	-
0x4015:024	Digital input status: Level from digital input 8	- (Read only)	general	U8	1	X	-
0x401A:001	Digital output configuration: DO1 switch-off delay	**0.000 s**	general	U16	1000	P	-
0x401A:002	Digital output configuration: DO1 switch-on delay	**0.000 s**	general	U16	1000	P	-
0x401A:003	Digital output configuration: DO1 terminal state	- (Read only)	general	U8	1	X	-
0x401A:004	Digital output configuration: DO1 trigger signal state	- (Read only)	general	U8	1	X	-
0x401A:011	Digital output configuration: DO2 switch-off delay	**0.000 s**	general	U16	1000	P	-
0x401A:012	Digital output configuration: DO2 switch-on delay	**0.000 s**	general	U16	1000	P	-
0x401A:013	Digital output configuration: DO2 terminal state	- (Read only)	general	U8	1	X	-
0x401A:014	Digital output configuration: DO2 trigger signal state	- (Read only)	general	U8	1	X	-
0x401A:021	Digital output configuration: DO3 switch-off delay	**0.000 s**	general	U16	1000	P	-
0x401A:022	Digital output configuration: DO3 switch-on delay	**0.000 s**	general	U16	1000	P	-
0x401A:023	Digital output configuration: DO3 terminal state	- (Read only)	general	U8	1	X	-
0x401A:024	Digital output configuration: DO3 trigger signal state	- (Read only)	general	U8	1	X	-
0x401A:031	Digital output configuration: DO4 switch-off delay	**0.000 s**	general	U16	1000	P	-
0x401A:032	Digital output configuration: DO4 switch-on delay	**0.000 s**	general	U16	1000	P	-
0x401A:033	Digital output configuration: DO4 terminal state	- (Read only)	general	U8	1	X	-
0x401A:034	Digital output configuration: DO4 trigger signal state	- (Read only)	general	U8	1	X	-
0x401F:001	Process controller diagnostics: Current setpoint	x.xx PID unit (Read only)	general	S16	100	O	t
0x401F:002	Process controller diagnostics: Current process variable	x.xx PID unit (Read only)	general	S16	100	O	t
0x401F:003	Process controller diagnostics: Status	- (Read only)	general	U8	1	O	t
0x401F:004	Process controller diagnostics: PID control value	x.x Hz (Read only)	general	S16	10	-	-
0x401F:005	Process controller diagnostics: PID Feedforward value	x.x Hz (Read only)	general	S16	10	-	-
0x401F:006	Process controller diagnostics: PID output value	x.x Hz (Read only)	general	S16	10	-	-
0x401F:007	Process controller diagnostics: PID error value	x.xx PID unit (Read only)	general	S32	100	-	-
0x4020:001	Process controller setup (PID): Operating mode	**Inhibited [0]**	general	U8	1	P	-
0x4020:002	Process controller setup (PID): PID process variable	**Network [5]**	general	U8	1	P	-
0x4020:003	Process controller setup (PID): Closed-loop controlled speed range	**100 %**	general	U16	1	P	rt
0x4020:004	Process controller setup (PID): Speed feedforward control source	**Without speed addition [0]**	general	U8	1	P	-
0x4020:005	Process controller setup (PID): Min speed limit	**-100.0 %**	general	S16	10	P	-
0x4020:006	Process controller setup (PID): Max speed limit	**100.0 %**	general	S16	10	P	-
0x4021:001	PID speed operation: Acceleration time	**1.0 s**	general	U16	10	P	-
0x4021:002	PID speed operation: Deceleration time	**1.0 s**	general	U16	10	P	-
0x4022:001	PID setpoint presets: Preset 1	**0.00 PID unit**	general	S16	100	P	-
0x4022:002	PID setpoint presets: Preset 2	**0.00 PID unit**	general	S16	100	P	-
0x4022:003	PID setpoint presets: Preset 3	**0.00 PID unit**	general	S16	100	P	-
0x4022:004	PID setpoint presets: Preset 4	**0.00 PID unit**	general	S16	100	P	-
0x4022:005	PID setpoint presets: Preset 5	**0.00 PID unit**	general	S16	100	P	-
0x4022:006	PID setpoint presets: Preset 6	**0.00 PID unit**	general	S16	100	P	-
0x4022:007	PID setpoint presets: Preset 7	**0.00 PID unit**	general	S16	100	P	-

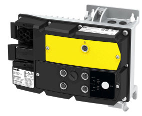
* Default setting dependent on the model.



Address	Name	Default setting	Category	Data type	Factor	A	M
0x4022:008	PID setpoint presets: Preset 8	**0.00 PID unit**	general	S16	100	P	-
0x4023:001	PID sleep mode: Activation	**Disabled [0]**	general	U8	1	P	-
0x4023:002	PID sleep mode: Stop method	**Coasting [0]**	general	U8	1	P	-
0x4023:003	PID sleep mode: Frequency threshold	**0.0 Hz**	general	U16	10	P	-
0x4023:004	PID sleep mode: Feedback threshold	**0.00 PID unit**	general	S16	100	P	-
0x4023:005	PID sleep mode: Delay time	**0.0 s**	general	U16	10	P	-
0x4023:006	PID sleep mode: Recovery	**Setpoint > threshold OR system deviation > bandwidth [0]**	general	U8	1	P	-
0x4023:007	PID sleep mode: Bandwidth	**0.00 PID unit**	general	U16	100	P	-
0x4023:008	PID sleep mode: Recovery threshold	**0.00 PID unit**	general	S16	100	P	-
0x4024:001	Automatic rinsing: Rinsing in sleep mode	**Inhibited [0]**	general	U8	1	P	-
0x4024:002	Automatic rinsing: Rinse interval	**30.0 min**	general	U16	10	P	-
0x4024:003	Automatic rinsing: Rinse speed	**0.0 Hz**	general	S16	10	P	-
0x4024:004	Automatic rinsing: Rinse period	**0.0 s**	general	U16	10	P	-
0x4041:001 ... 0x4041:032	Parameter change-over: Parameter 1 ... Parameter 32	**0**	general	IDX		PH	-
0x4042:001 ... 0x4042:032	Parameter value set 1: Value of parameter 1 ... Value of parameter 32	**0**	general	S32	1	P	-
0x4043:001 ... 0x4043:032	Parameter value set 2: Value of parameter 1 ... Value of parameter 32	**0**	general	S32	1	P	-
0x4044:001 ... 0x4044:032	Parameter value set 3: Value of parameter 1 ... Value of parameter 32	**0**	general	S32	1	P	-
0x4045:001 ... 0x4045:032	Parameter value set 4: Value of parameter 1 ... Value of parameter 32	**0**	general	S32	1	P	-
0x4046	Activation of parameter set	**Via command (disable required) [0]**	general	U8	1	P	-
0x4047:001	Parameter change-over error message: Status	- (Read only)	general	U16	1	-	-
0x4047:002	Parameter change-over error message: List entry	- (Read only)	general	U8	1	X	-
0x4048	PID P-component	**5.0 %**	general	U16	10	P	rt
0x4049	PID I- component	**400 ms**	general	U16	1	P	rt
0x404A	PID D-component	**0.0 s**	general	U8	10	P	rt
0x404B	PID setpoint ramp	**20.0 s**	general	U16	10	P	-
0x404C:001	PID influence: Acceleration time for activation	**5.0 s**	general	U16	10	P	-
0x404C:002	PID influence: Deceleration time for masking out	**5.0 s**	general	U16	10	P	-
0x404C:003	PID influence: PID influence factor	**100.0 %**	general	S16	10	P	r
0x404D:001	PID alarms: MIN alarm threshold	**0.00 PID unit**	general	S16	100	P	-
0x404D:002	PID alarms: MAX alarm threshold	**100.00 PID unit**	general	S16	100	P	-
0x404D:003	PID alarms: Monitoring bandwidth PID feedback signal	**2.00 PID unit**	general	U16	100	P	-
0x404E:001	PID setpoint limits: Minimum setpoint	**-300.00 PID unit**	general	S16	100	P	-
0x404E:002	PID setpoint limits: Maximum setpoint	**300.00 PID unit**	general	S16	100	P	-
0x603F	Error code	- (Read only)	general	U16	1	O	t
0x6040	CiA control word	**0**	general	U16	1	O	r
0x6041	CiA status word	- (Read only)	general	U16	1	O	t
0x6042	Set speed	**0 rpm**	general	S16	1	O	r
0x6043	Internal set speed	x rpm (Read only)	general	S16	1	O	t
0x6044	Actual speed	x rpm (Read only)	MCTRL	S16	1	O	t
0x6046:001	Speed limits: Min. speed	**0 rpm**	general	U32	1	OP	r
0x6046:002	Speed limits: Max. speed	**2147483647 rpm**	general	U32	1	OP	r
0x6048:001	Acceleration ramp: CiA acceleration: Delta speed	**3000 rpm**	general	U32	1	OP	r
0x6048:002	Acceleration ramp: CiA acceleration: Delta time	**10 s**	general	U16	1	OP	r
0x6049:001	Deceleration ramp: CiA deceleration: Delta speed	**3000 rpm**	general	U32	1	OP	r
0x6049:002	Deceleration ramp: CiA deceleration: Delta time	**10 s**	general	U16	1	OP	r
0x605A	CiA: Quick stop mode	**Ramp > switch on disabled [2]**	general	S16	1	P	-

* Default setting dependent on the model.

Address	Name	Default setting	Category	Data type	Factor	A	M
0x605B	Shutdown option code	**Disable drive function [0]**	general	S16	1	P	-
0x6060	CiA: Operation mode	**MS: Velocity mode [-2]**	general	S8	1	OPC	r
0x6061	CiA: Active operation mode	- (Read only)	general	S8	1	O	t
0x6071	Set torque	**0.0 %**	general	S16	10	O	r
0x6072	Max. torque	**250.0 %**	general	U16	10	OP	r
0x6073	Max. current	**200.0 %**	MCTRL	U16	10	P	r
0x6074	Internal set torque	x.x % (Read only)	MCTRL	S16	10	O	-
0x6075	Rated motor current	**1.420 A**	MCTRL	U32	1000	PC	-
0x6076	Rated motor torque	**1.650 Nm**	MCTRL	U32	1000	PC	-
0x6077	Actual torque	x.x % (Read only)	MCTRL	S16	10	O	t
0x6078	Actual current	x.x % (Read only)	MCTRL	S16	10	O	t
0x6079	DC-bus voltage	x.xxx V (Read only)	MCTRL	U32	1000	O	t
0x6080	Max. motor speed	**6075 rpm**	MCTRL	U32	1	P	r
0x6085	Quick stop deceleration	**546000 inc/s²**	general	U32	1	P	-
0x60E0	Positive torque limit	**250.0 %**	general	U16	10	P	r
0x60E1	Negative torque limit	**250.0 %**	general	U16	10	P	r
0x60FD	Digital input status	- (Read only)	general	U32	1	O	t
0x6402	Motor type	**Squirrel cage induction [7]**	EtherNet/IP	U16	1	P	-
* Default setting dependent on the model.							



18.2 Glossary

Definitions in functional safety

Abbreviation	Meaning
AIE	Acknowledge In Error, error acknowledgement
AIS	Acknowledge In Stop, restart acknowledgement
OFF state	Triggered signal status of the safety sensors
CCF	Common Cause Error (also β-value)
EC_FS	Error Class Fail Safe
EC_SS1	Error Class Safe Stop 1
EC_SS2	Error Class Safe Stop 2
EC_STO	Error Class Safe Torque Off Stop 0
ON state	Signal status of the safety sensors in normal operation
FIT	Failure In Time, 1 FIT = 10-9 Error/h
FMEA	Failure Mode and Effect Analysis
FSoE	FailSafe over EtherCAT
GSDML	Device description file with PROFINET-specific data to integrate the configuring software of a PROFINET controller.
HFT	Hardware Failure Tolerance
Cat.	Category according to EN ISO 13849-1
nBD	Speed value Base-Drive, internally determined actual speed from standard application
nSD	Safe-Drive speed value, internally determined actual speed from the safety application
n_safe	Actual speed determined from validation of nBD and nSD. Enters the further processing of the speed-dependent safety functions.
OSSD	Output Signal Switching Device, tested signal output
pBD	Base-Drive position value, internally determined actual position from standard application
pSD	Safe-Drive position value, internally determined actual position from the safety application
p_safe	Actual position determined from validation of pBD and pSD. Enters the further processing of the position-dependent safety functions.
PELV	Protective Extra Low Voltage
PL	Performance Level according to EN ISO 13849-1
PM	Plus–Minus – switched signal paths
PP	Plus–Plus – switched signal paths
PS	PROFIsafe
PWM	Pulse Width Modulation
SCS	Safe Creeping Speed
SD–In	Safe Digital Input
SD–Out	Safe Digital Output
SELV	Safety Extra Low Voltage
SFF	Safe Failure Fraction
SIL	Safety Integrity Level according to EN IEC 61508