

• 15G0132B100 •

SINUS S

AC DRIVE 0.37 ... 37 kW / 0.5 ... 50 HP

Configuring the Network

Issued on 27/10/2021

R.01

- This manual is integrant and essential to the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
- This device is to be used only for the purposes it has been designed to. Other uses should be considered improper and dangerous. The manufacturer is not responsible for possible damages caused by improper, erroneous and irrational uses.
- Enertronica Santerno S.p.A. is responsible for the product in its original setting.
- Any changes to the structure or operating cycle of the product must be performed or authorized by Enertronica Santerno S.p.A.
- Enertronica Santerno S.p.A. assumes no responsibility for the consequences resulting by the use of non-original spare-parts.
- Enertronica Santerno S.p.A. reserves the right to make any technical changes to this manual and to the product without prior notice. If printing errors or similar are detected, the corrections will be included in the new releases of the manual.
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Enertronica Santerno S.p.A.
Via della Concia, 7 – 40023 Castel Guelfo (BO) Italy
Tel. +39 0542 489711 – Fax +39 0542 489722
santerno.com info@santerno.com

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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
06.02.00.00	V0015	2020-09-14

1.2 Further documents

For certain tasks, information is available in further documents.

Document	Contents/topics
Configuration document	Basic information on project planning and ordering the product
Commissioning document	Fundamental information for the installation and commissioning of the product
"Functional safety" configuration document	Basic information on configuring "functional safety" of the product
Quick Reference Card	Brief information about operation and device properties of the product

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 Enertronica Santerno products can be found on the Internet:
santerno.com

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: "Engineer", "Remote Sinus"
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

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

Observe all specifications of the corresponding documentation supplied. This is the precondition for safe and trouble-free operation and for obtaining the product features specified.

Please observe the specific safety information in the other sections!

2.1 Basic safety instructions

DANGER!

Dangerous electrical voltage

Possible consequences: Death or severe injuries from electric shock

- ▶ Any work on the device must only be carried out in a deenergized state.
- ▶ After switching off the mains voltage, observe the signs on the product.

Product

The product must only be used as directed.

Never commission the product in the event of visible damage.

The product must never be technically modified.

Never commission the product before assembly has been completed.

The product must never be operated without required covers.

Connect/disconnect all pluggable terminals only in de-energized condition.

Only remove the product from the installation in the de-energized state.

Personnel

Only qualified and skilled personnel are allowed to work with the product. IEC 60364 and/or CENELEC HD 384 define the qualifications of these persons as follows:

They are familiar with the installation, mounting, commissioning, and operation of the product.

They possess the appropriate qualifications for their tasks.

They are familiar with all regulations for the prevention of accidents, directives, and laws applicable at the location and are able to apply them.

Process engineering

The procedural notes and circuit details described are only proposals. It is up to the user to check whether they can be adapted to the particular applications. Enertronica Santerno does not take any responsibility for the suitability of the procedures and circuit proposals described.

Device protection

The maximum test voltage for insulation tests between a control potential of 24 V and PE must not exceed 110 V DC (EN 61800-5-1).

2.2 Application as directed

The product serves as a component for the control of three-phase AC motors and servo motors.

The product must only be actuated with motors that are suitable for the operation with inverters.

The product is not a household appliance, but is only designed as electrical equipment for commercial or professional use in terms of EN 61000-3-2.

The product is exclusively suitable for installation in control cabinets or similarly closed operating areas.

The product must only be operated under the operating conditions prescribed in this documentation.

The product meets the protection requirements of 2014/35/EU: Low-Voltage Directive.

The product is not a machine in terms of 2006/42/EU: Machinery Directive. With the exception of all functional safety functions.

Commissioning or starting the operation as directed of a machine with the product is not permitted until it has been ensured that the machine meets the regulations of the EC Directive 2006/42/EU: Machinery Directive; observe EN 60204-1.

Commissioning or starting operation as directed is only permissible if the EMC Directive 2014/30/EU is complied with.

As the product may cause EMC interferences in residential areas, the operator is responsible for taking interference suppression measures.

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.

If the safety module is defective, the inverter has to be replaced.

2.3 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!

DANGER!

Danger to life due to electrical voltage!

The product's power connections can still be carrying voltage when the mains supply has been switched off.

Possible consequences: Death, severe injury, or burns

- ▶ Do not touch the power connections immediately.
- ▶ Take note of the corresponding warning plates on the product.
- ▶ Check power terminals for isolation from supply.

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.

Information does not apply to the wire range of the terminals.

Terminals that are not wired have low protection against physical contact.

Terminals for large cable cross-sections have lower classes of protection, e. g. from 15 kW IP10 only.

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.

Switch contactors in the motor cable only if the controller is inhibited.

Switching while the inverter is enabled is only permissible if no monitoring functions are activated.

Motor

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

3. Configuring the network

The inverter has various basic functions for network control. The inverter also supports multiple device profiles and is available in versions with different network options.

Basic functions for network control

- ▶ [Control the inverter via network](#)
- ▶ [Define setpoint via network](#)
- ▶ [Further mappable parameters](#)
- ▶ [Parameter access monitoring \(PAM\)](#)
- ▶ [Process data handling in the event of error](#)

Supported device profiles

- ▶ [CiA402 device profile](#)
- ▶ [AC drive profile](#)

Network options

- ▶ [CANopen](#)
- ▶ [EtherCAT](#)
- ▶ [EtherNet/IP](#)
- ▶ [Modbus RTU](#)
- ▶ [Modbus TCP](#)
- ▶ [PROFIBUS](#)
- ▶ [PROFINET](#)

3.1 Control the inverter via network

3.1.1 Activate network control

In order to be able to control the inverter via network, a trigger must be first assigned in [0x2631:037 \(P400.37\)](#) 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, the motor can only be started via the network control word.

Exception: jog operation; see chapter "[Start, stop and rotating direction commands](#)".

In order to control the inverter from the network, the network share [0x2631:037 \(P400.37\)](#) must be configured.

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

- [0x2631:001 \(P400.01\)](#): Inverter enable
- [0x2631:002 \(P400.02\)](#): Run
- [0x2631:003 \(P400.03\)](#): Activate quick stop
- [0x2631:004 \(P400.04\)](#): Reset error
- [0x2631:005 \(P400.05\)](#): DC braking
- [0x2631:010 \(P400.10\)](#): Jog forward (CW)
- [0x2631:011 \(P400.11\)](#): Jog reverse (CCW)*
- [0x2631:012 \(P400.12\)](#): Activate keypad control*
- [0x2631:037 \(P400.37\)](#): Activate network control*
- [0x2631:043 \(P400.43\)](#): Activate fault 1
- [0x2631:044 \(P400.44\)](#): Activate fault 2
- [0x2631:054 \(P400.54\)](#): Reset position counter

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

In case of an activated network control, the following functions are also still active if they are not configured in the NetWordIN1 bit functionality:

- [0x2631:048 \(P400.48\)](#): Activate PID influence ramp
- [0x2631:041 \(P400.41\)](#): Select parameter set (bit 0)
- [0x2631:042 \(P400.42\)](#): Select parameter set (bit 1)

All other functions configurable via [0x2631:xx \(P400.xx\)](#) are deactivated in case of network control.

Parameter

Address	Name / setting range / [default setting]	Information
0x2631:037 (P400.37)	Function list: Activate network control (Function list: Network control) • Further possible settings: ▶ Trigger list	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 (P592.01) . 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

3.1.2 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 OUT A0
Network IN A1	Network OUT A1
Network IN A2	Network OUT A2
Network IN A3	Network OUT A3
Network IN B0	Network OUT B0
Network IN B1	Network OUT B1
Network IN B2	Network OUT B2
Network IN B3	Network OUT B3
Network IN C0	Network OUT C0
Network IN C1	Network OUT C1
Network IN C2	Network OUT C2
Network IN C3	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 attributelist](#)

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
CiA status word	0x6041 (P780.00)	0x60410010	
AC Drive control word	0x400B:001 (P592.01)	0x400B0110	▶ AC drive
AC Drive status word	0x400C:001 (P593.01)	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](#)
- ▶ [Define your own status word format](#)
- ▶ [Further mappable parameters](#)

General information about the process of data mapping can be found in the chapter of the same name for the corresponding network.

3.1.3 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 (P590.01)	0x40080110	The functions that are to be triggered via bits 0 ... 15 of the NetWordIN1 data word are defined in 0x400E:001 (P505.01) ... 0x400E:016 (P505.16) .
* 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 (P590.01)	Process input words: NetWordIN1 (NetWordINx: 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 (P505.01)
	Bit 1	Mapping bit 1	Assignment of the function: 0x400E:002 (P505.02)
	Bit 2	Mapping bit 2	Assignment of the function: 0x400E:003 (P505.03)
	Bit 3	Mapping bit 3	Assignment of the function: 0x400E:004 (P505.04)
	Bit 4	Mapping bit 4	Assignment of the function: 0x400E:005 (P505.05)
	Bit 5	Mapping bit 5	Assignment of the function: 0x400E:006 (P505.06)
	Bit 6	Mapping bit 6	Assignment of the function: 0x400E:007 (P505.07)
	Bit 7	Mapping bit 7	Assignment of the function: 0x400E:008 (P505.08)
	Bit 8	Mapping bit 8	Assignment of the function: 0x400E:009 (P505.09)
	Bit 9	Mapping bit 9	Assignment of the function: 0x400E:010 (P505.10)
	Bit 10	Mapping bit 10	Assignment of the function: 0x400E:011 (P505.11)
	Bit 11	Mapping bit 11	Assignment of the function: 0x400E:012 (P505.12)
	Bit 12	Mapping bit 12	Assignment of the function: 0x400E:013 (P505.13) Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: <ul style="list-style-type: none"> Relay: 0x2634:001 (P420.01) / selection [30] Digital output 1: 0x2634:002 (P420.02) / selection [30] Digital output 2: 0x2634:003 (P420.03) / 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 behaviour!
	Bit 13	Mapping bit 13	Assignment of the function: 0x400E:014 (P505.14) Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: <ul style="list-style-type: none"> Relay: 0x2634:001 (P420.01) / selection [31] Digital output 1: 0x2634:002 (P420.02) / selection [31] Digital output 2: 0x2634:003 (P420.03) / 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 behaviour!
	Bit 14	Mapping bit 14	Assignment of the function: 0x400E:015 (P505.15) Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: <ul style="list-style-type: none"> Relay: 0x2634:001 (P420.01) / selection [32] Digital output 1: 0x2634:002 (P420.02) / selection [32] Digital output 2: 0x2634:003 (P420.03) / 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 behaviour!
	Bit 15	Mapping bit 15	Assignment of the function: 0x400E:016 (P505.16) Alternatively, this mapping bit can be used for controlling the digital outputs. Assignment of the digital outputs: <ul style="list-style-type: none"> Relay: 0x2634:001 (P420.01) / selection [33] Digital output 1: 0x2634:002 (P420.02) / selection [33] Digital output 2: 0x2634:003 (P420.03) / 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 behaviour!

Address	Name / setting range / [default setting]	Information
0x400E:001 (P505.01)	NetWordIN1 function: Bit 0 (NetWordIN1 fct.: NetWordIN1.00) • 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: <ul style="list-style-type: none"> 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 (P203.03). 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 (P126.01).
	2 Stopping	Trigger bit = 1: Motor is stopped. Trigger bit = 0: No action / Deactivate stop again. Notes: <ul style="list-style-type: none"> The stop method can be selected in 0x2838:003 (P203.03).
	3 Activate quick stop	Trigger bit = 1: "Quick stop" function activated. Trigger bit = 0: no action / deactivate function again. Notes: <ul style="list-style-type: none"> The "Quick stop" function brings the motor to a standstill within the deceleration time set in 0x291C (P225.00). 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: <ul style="list-style-type: none"> After resetting the error, a new enable/start command is required to restart the motor.
	5 Activate DC braking	Trigger bit = 1: "DC braking" function activated. Trigger bit = 0: no action / deactivate function again. ▶ DC braking
	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: <ul style="list-style-type: none"> The stop method can be selected in 0x2838:003 (P203.03). 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 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)	<p>Trigger bit = 0-1 edge: Motor is started in the reverse rotating direction (CCW).</p> <p>Trigger bit = 1-0 edge: Motor is stopped again.</p> <p>Notes:</p> <ul style="list-style-type: none"> The stop method can be selected in 0x2838:003 (P203.03). 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. <ul style="list-style-type: none"> ▶ Start behavior The "Reverse rotational direction [13]" function can be used in connection with this function.
	13 Reverse rotational direction	<p>Trigger bit = 1: the setpoint specified is inverted (i. e. the sign is inverted).</p> <p>Trigger bit = 0: no action / deactivate function again.</p>
	14 Activate AI1 setpoint	<p>Trigger bit = 1: analog input 1 is used as setpoint source (if the trigger bit assigned has the highest setpoint priority).</p> <p>Trigger bit = 0: no action / deactivate function again.</p> <p>▶ Analog input 1</p>
	15 Activate AI2 setpoint	<p>Trigger bit = 1: analog input 2 is used as setpoint source (if the trigger bit assigned has the highest setpoint priority).</p> <p>Trigger bit = 0: no action / deactivate function again.</p> <p>▶ Analog input 2</p>
	17 Activate network setpoint	<p>Trigger bit = 1: the network is used as setpoint source (if the trigger bit assigned has the highest setpoint priority).</p> <p>Trigger bit = 0: no action / deactivate function again.</p>
	18 Activate preset (bit 0)	<p>Selection bits for bit coded selection and activation of a parameterised setpoint (preset).</p> <p>▶ Setpoint presets</p>
	19 Activate preset (bit 1)	
	20 Activate preset (bit 2)	
	21 Activate preset (bit 3)	
	26 Activate segment 1 setpoint	<p>Selection bits for bit coded selection and activation of a parameterised segment setpoint.</p> <p>Notes:</p> <ul style="list-style-type: none"> During normal operation (no active sequence), this function serves to activate the setpoint of a segment (instead of an entire sequence in the sequencer operation). This function is not intended for the use in the sequencer operation. <p>▶ Segment configuration</p>
	27 Activate segment 2 setpoint	
	28 Activate segment 3 setpoint	
	29 Activate segment 4 setpoint	
	30 Run/abort sequence	<p>Trigger bit = 1: Start selected sequence.</p> <p>Trigger bit = 0: Abort sequence.</p> <p>Notes:</p> <ul style="list-style-type: none"> The assigned trigger bit must remain set to "1" for the duration of the sequence. If the trigger bit is reset to "0", the sequence is aborted. In this case, the standard setpoint or the setpoint source selected via setpoint change-over is active again. A sequence is selected in a binary-coded fashion via the trigger bits assigned to the four functions "Select sequence (bit 0) [50]" ... "Select sequence (bit 3) [53]". <p>▶ Sequencer</p>
	32 Next sequence step	<p>Trigger bit = 0 \rightarrow 1 (edge): Next sequence step.</p> <p>Trigger bit = 1 \rightarrow 0 (edge): No action.</p> <p>Notes:</p> <ul style="list-style-type: none"> The execution of the current step is completed even if the time parameterised for the segment has not elapsed yet. The function is only relevant for Sequencer mode 0x4025 (P800.00) = "Step operation [2]" or "Time & step operation [3]". A jump to the next sequence step is not possible if the sequence pauses, the sequence is suspended or the final segment is executed. <p>▶ Sequencer</p>

Address	Name / setting range / [default setting]	Information
33	Pause sequence	<p>Trigger bit = 1: Pause sequence. Trigger bit = 0: Continue sequence.</p> <p>Notes:</p> <ul style="list-style-type: none"> During the pause, the sequence stops in the current step. The expiration of the time set for the segment is stopped. The sequencer setpoint continues to remain active. <p>► Sequencer</p>
34	Suspend sequence	<p>Trigger bit = 1: Suspend sequence. Trigger bit = 0: Continue sequence.</p> <p>Notes:</p> <ul style="list-style-type: none"> This function serves to temporarily change over to the standard setpoint or the setpoint source selected via setpoint change-over. The sequence is continued at the point where it was suspended. <p>► Sequencer</p>
35	Stop sequence	<p>Trigger bit = 0→1 (edge): Stop sequence. Trigger bit = 1→0 (edge): No action.</p> <p>Notes:</p> <ul style="list-style-type: none"> If the sequence is stopped, it is jumped to the final segment. The further execution depends on the selected End of sequence mode 0x402F (P824.00). <p>► Sequencer</p>
36	Abort sequence	<p>Trigger bit = 0→1 (edge): Abort sequence. Trigger bit = 1→0 (edge): No action.</p> <p>Notes:</p> <ul style="list-style-type: none"> This function serves to directly stop the sequence without the final segment being executed. In this case, the standard setpoint or the setpoint source selected via setpoint change-over is active again. <p>► Sequencer</p>
39	Activate ramp 2	<p>Trigger bit = 1: activate acceleration time 2 and deceleration time 2 manually. Trigger bit = 0: no action / deactivate function again.</p> <p>► Ramp times</p>
40	Load parameter set	<p>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.</p> <p>Notes:</p> <ul style="list-style-type: none"> The activation method for the "Parameter change-over" function can be selected in 0x4046 (P755.00). <p>► Parameter change-over</p>
41	Select parameter set (bit 0)	<p>Selection bits for the "Parameter change-over" function.</p> <p>► Parameter change-over</p>
42	Select parameter set (bit 1)	
43	Activate fault 1	<p>Trigger bit = 1: Trigger user-defined error 1. Trigger bit = 0: no action.</p> <p>Notes:</p> <ul style="list-style-type: none"> After the error is triggered, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. <p>Associated error code:</p> <ul style="list-style-type: none"> 25249 0x62A1 - Network: user fault 1
44	Activate fault 2	<p>Trigger bit = 1: Trigger user-defined error 2. Trigger bit = 0: no action.</p> <p>Notes:</p> <ul style="list-style-type: none"> After the error is triggered, the motor is brought to a standstill with the quick stop ramp. The inverter is then disabled. <p>Associated error code:</p> <ul style="list-style-type: none"> 25250 0x62A2 - Network: user fault 2

Address	Name / setting range / [default setting]	Information
	45 Deactivate PID controlling	<p>Trigger bit = 1: If PID control is activated, ignore PID control and drive the motor in speed-controlled manner.</p> <p>Trigger bit = 0: If PID control is activated, drive the motor with PID control.</p> <p>Notes:</p> <ul style="list-style-type: none"> The PID control can be activated in 0x4020:001 (P600.01). <p>► Configuring the process controller</p>
	46 Set PID output to 0	<p>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.</p> <p>Trigger bit = 0: No action / deactivate function again.</p> <p>► Configuring the process controller</p>
	47 Inhibit PID I-component	<p>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.</p> <p>Trigger bit = 0: No action / deactivate function again.</p> <p>► Configuring the process controller</p>
	48 Activate PID influence ramp	<p>Trigger bit = 1: the influence of the process controller is shown by means of a ramp.</p> <p>Trigger bit = 0 or not connected: the influence of the process controller is shown by means of a ramp.</p> <p>Notes:</p> <ul style="list-style-type: none"> 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 (P607.01). Deceleration time for hiding the influence of the process controller can be set in 0x404C:002 (P607.02). <p>► Configuring the process controller</p>
	49 Release holding brake	<p>Trigger bit = 1: Release holding brake manually.</p> <p>Trigger bit = 0: No action.</p> <p>Notes:</p> <ul style="list-style-type: none"> 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. <p>► Holding brake control</p>
	50 Select sequence (bit 0)	<p>Selection bits for bit coded selection of a sequence.</p> <p>Notes:</p> <ul style="list-style-type: none"> The selected sequence is not started automatically. For a status-controlled start, the function "Run/abort sequence[30]" is available. <p>► Sequencer control functions</p>
	51 Select sequence (bit 1)	
	52 Select sequence (bit 2)	
	53 Select sequence (bit 3)	
	54 Position counter reset	<p>Trigger bit = 1: Reset position counter manually.</p> <p>Trigger bit = 0: No action.</p> <p>► Position counter</p>
	55 Activate UPS operation	<p>Trigger bit = 1: Activate UPS operation.</p> <p>Trigger bit = 0: No action / deactivate function again.</p> <p>► Operation with UPS</p>
0x400E:002 (P505.02)	<p>NetWordIN1 function: Bit 1 (NetWordIN1 fct.: NetWordIN1.01)</p> <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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.

Address	Name / setting range / [default setting]	Information
0x400E:003 (P505.03)	NetWordIN1 function: Bit 2 (NetWordIN1 fct.: NetWordIN1.02) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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: <ul style="list-style-type: none"> The "Quick stop" function brings the motor to a standstill within the deceleration time set in 0x291C (P225.00). The "Quick stop" function has a higher priority than the "Run" function.
0x400E:004 (P505.04)	NetWordIN1 function: Bit 3 (NetWordIN1 fct.: NetWordIN1.03) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01) 	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.
0x400E:005 (P505.05)	NetWordIN1 function: Bit 4 (NetWordIN1 fct.: NetWordIN1.04) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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: <ul style="list-style-type: none"> The stop method can be selected in 0x2838:003 (P203.03). 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 The "Reverse rotational direction [13]" function can be used in connection with this function.
0x400E:006 (P505.06)	NetWordIN1 function: Bit 5 (NetWordIN1 fct.: NetWordIN1.05) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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
0x400E:007 (P505.07)	NetWordIN1 function: Bit 6 (NetWordIN1 fct.: NetWordIN1.06) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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

Address	Name / setting range / [default setting]	Information
0x400E:008 (P505.08)	NetWordIN1 function: Bit 7 (NetWordIN1 fct.: NetWordIN1.07) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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: <ul style="list-style-type: none"> After resetting the error, a new enable/start command is required to restart the motor.
0x400E:009 (P505.09)	NetWordIN1 function: Bit 8 (NetWordIN1 fct.: NetWordIN1.08) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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 (P505.10)	NetWordIN1 function: Bit 9 (NetWordIN1 fct.: NetWordIN1.09) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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
0x400E:011 (P505.11)	NetWordIN1 function: Bit 10 (NetWordIN1 fct.: NetWordIN1.10) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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 (P505.12)	NetWordIN1 function: Bit 11 (NetWordIN1 fct.: NetWordIN1.11) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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 (P505.13)	NetWordIN1 function: Bit 12 (NetWordIN1 fct.: NetWordIN1.12) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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 (P505.14)	NetWordIN1 function: Bit 13 (NetWordIN1 fct.: NetWordIN1.13) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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.

Address	Name / setting range / [default setting]	Information
0x400E:015 (P505.15)	NetWordIN1 function: Bit 14 (NetWordIN1 fct.: NetWordIN1.14) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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 (P505.16)	NetWordIN1 function: Bit 15 (NetWordIN1 fct.: NetWordIN1.15) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. For further possible settings, see parameter 0x400E:001 (P505.01). 	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.

3.1.4 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 (P591.01)	0x400A0110	The triggers for bits 0 ... 15 of the NetWordOUT1 data word are defined in 0x2634:010 (P420.10) ... 0x2634:025 (P420.25) .
* 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 (P420.10)	Digital outputs function: NetWordOUT1 - bit 0 (Dig.out.function: NetWordOUT1.00) <ul style="list-style-type: none"> For further possible settings, see parameter 0x2634:001 (P420.01). 	Assignment of a trigger to bit 0 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	51 Ready for operation	TRUE if inverter is ready for operation (no error active, no STO active and DC-bus voltage ok). Otherwise FALSE.
0x2634:011 (P420.11)	Digital outputs function: NetWordOUT1 - bit 1 (Dig.out.function: NetWordOUT1.01) <ul style="list-style-type: none"> For further possible settings, see parameter 0x2634:001 (P420.01). 	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 (P420.12)	Digital outputs function: NetWordOUT1 - bit 2 (Dig.out.function: NetWordOUT1.02) <ul style="list-style-type: none"> For further possible settings, see parameter 0x2634:001 (P420.01). 	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.
0x2634:013 (P420.13)	Digital outputs function: NetWordOUT1 - bit 3 (Dig.out.function: NetWordOUT1.03) <ul style="list-style-type: none"> For further possible settings, see parameter 0x2634:001 (P420.01). 	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 (P420.14)	Digital outputs function: NetWordOUT1 - bit 4 (Dig.out.function: NetWordOUT1.04) <ul style="list-style-type: none"> For further possible settings, see parameter 0x2634:001 (P420.01). 	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 (P420.15)	Digital outputs function: NetWordOUT1 - bit 5 (Dig.out.function: NetWordOUT1.05) <ul style="list-style-type: none"> For further possible settings, see parameter 0x2634:001 (P420.01). 	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.

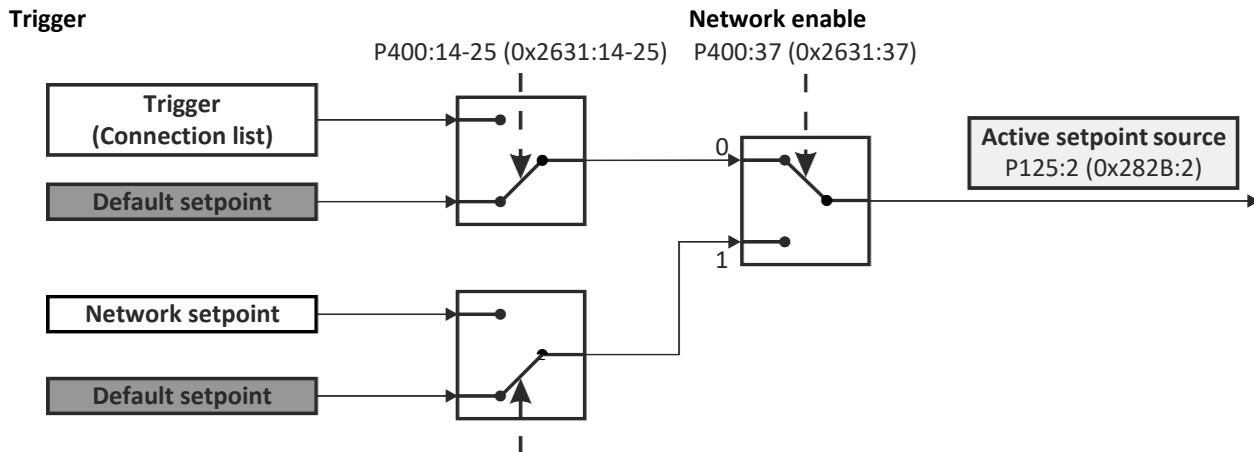
Address	Name / setting range / [default setting]	Information
0x2634:016 (P420.16)	Digital outputs function: NetWordOUT1 - bit 6 (Dig.out.function: NetWordOUT1.06) • For further possible settings, see parameter 0x2634:001 (P420.01) .	Assignment of a trigger to bit 6 of NetWordOUT1. Trigger = FALSE: bit 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 (P420.17)	Digital outputs function: NetWordOUT1 - bit 7 (Dig.out.function: NetWordOUT1.07) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 (P420.18)	Digital outputs function: NetWordOUT1 - bit 8 (Dig.out.function: NetWordOUT1.08) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 (P420.19)	Digital outputs function: NetWordOUT1 - bit 9 (Dig.out.function: NetWordOUT1.09) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 (P420.20)	Digital outputs function: NetWordOUT1 - bit 10 (Dig.out.function: NetWordOUT1.10) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 (P420.21)	Digital outputs function: NetWordOUT1 - bit 11 (Dig.out.function: NetWordOUT1.11) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 \geq maximum current. Otherwise FALSE. • Display of the present motor current in 0x2D88 (P104.00) . • Setting for the maximum current in 0x6073 (P324.00) .
0x2634:022 (P420.22)	Digital outputs function: NetWordOUT1 - bit 12 (Dig.out.function: NetWordOUT1.12) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 (\pm 0.3 Hz), irrespective of the operating mode. Otherwise FALSE. • Display of the current output frequency in 0x2DDD (P100.00) .
0x2634:023 (P420.23)	Digital outputs function: NetWordOUT1 - bit 13 (Dig.out.function: NetWordOUT1.13) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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 (P420.24)	Digital outputs function: NetWordOUT1 - bit 14 (Dig.out.function: NetWordOUT1.14) • For further possible settings, see parameter 0x2634:001 (P420.01) .	Assignment of a trigger to bit 14 of NetWordOUT1. Trigger = FALSE: bit set to 0. Trigger = TRUE: bit set to 1.
	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 (P712.12) for closing the holding brake influences in this case the time-dependent behaviour of the output. ► Holding brake control

Address	Name / setting range / [default setting]	Information
0x2634:025 (P420.25)	Digital outputs function: NetWordOUT1 - bit 15 (Dig.out.function: NetWordOUT1.15) • For further possible settings, see parameter 0x2634:001 (P420.01) .	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)
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 (P591.01)	Process output words: NetWordOUT1 (NetWordOUTx: 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 (P420.10)
	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 (P420.11)
	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 (P420.12)
	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 (P420.13)
	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 (P420.14)
	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 (P420.15)
	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 (P420.16)
	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 (P420.17)
	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 (P420.18)
	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 (P420.19)
	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 (P420.20)
	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 (P420.21)
	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 (P420.22)
	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 (P420.23)
	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 (P420.24)
	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 (P420.25)

3.2 Define setpoint via network

The network setpoint must be explicitly selected if the setpoint is to be specified via the network.



Setpoint selection controlled with:

AC Drive Control Word
C135 Control Word
NETWordIN1

- ▶ Option 1: Define network as standard setpoint source
- ▶ Option 2: Change over to the network setpoint during operation

Mappable parameters

The following mappable parameters are available, among others, for specifying the setpoint.

- The parameters are always available irrespective of the network option.
- Additional mappable parameters with different resolutions are available for selection to transfer the frequency setpoint and actual frequency value. ▶ [Mappable parameters for exchanging setpoints and actual values](#)

Parameter

Address	Name / setting range / [default setting]	Information
0x400B:006 (P592.06)	Process input data: Velocity mode setpoint (Process data IN: Veloc. mode setp) -599.0 ... [0.0] ... 599.0 Hz	Mappable parameter for defining the setpoint for operating mode "MS: Velocity mode" via network. <ul style="list-style-type: none"> • If this parameter is to be used as standard setpoint source, the selection "Network [5]" must be set in 0x2860:001 (P201.01). • 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 (P592.07)	Process input data: PID setpoint (Process data IN: PID setpoint) -300.00 ... [0.00] ... 300.00 PID unit	Mappable parameter for defining the setpoint for the PID control via network. <ul style="list-style-type: none"> • If this parameter is to be used as standard setpoint source, the selection "Network [5]" must be set in 0x2860:002 (P201.02).
0x400B:008 (P592.08)	Process input data: Torque mode setpoint (Process data IN: Torque mode setp) -32768 ... [0] ... 32767 Nm	Mappable parameter for defining the setpoint for operating mode "MS: Torque mode" via network. <ul style="list-style-type: none"> • If this parameter is to be used as standard setpoint source, the selection "Network [5]" must be set in 0x2860:003 (P201.03). • The scaling factor can be set in 0x400B:009 (P592.09). • Scaled torque setpoint = torque setpoint (0x400B:008) / 2^{scaling factor} <p>Example:</p> <ul style="list-style-type: none"> • Torque setpoint (0x400B:008) = 345 [Nm] • Scaling factor (0x400B:009) = 3 • Scaled torque setpoint = 345 [Nm] / 2³ = 43.125 [Nm]

3.2.1 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 (P201.01)** = "Network [5]".
- See the following table for settings for additional controls.

Control: size	Parameter	Setting	Further information
Frequency control: frequency setpoint	0x2860:001 (P201.01)	Network [5]	Frequency control ▶ Standard setpoint source
PID control: reference value	0x2860:002 (P201.02)	Network [5]	Frequency control ▶ Configuring the process controller
PID control: feedback of the control variable (actual value)	0x4020:002 (P600.02)	Network [5]	
PID control: speed feedforward control	0x4020:004 (P600.04)	Network [8]	
Torque control: torque setpoint	0x2860:003 (P201.03)	Network [5]	Torque control ▶ Standard setpoint source

3.2.2 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 \(P201.01\)](#).
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 \(P125.02\)](#).



The setpoint change-over by means of the network control words is only possible if the controller is activated via the network [0x2631:037 \(P400.37\)](#).

The following table describes the change-over to the network setpoint via the different network control words:

Network control word	Change-over to network setpoint	
NetWordIN1 data word 0x4008:001 (P590.01)	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 (P505.01) ... 0x400E:016 (P505.16).	
	Bit x	Selection:
	0	Standard setpoint source selected in 0x2860:001 (P201.01).
	1	Network setpoint
AC drive control word 0x400B:001 (P592.01)	The network setpoint is activated via bit 6 of the AC Drive control word:	
	Bit 6	Selection:
	0	Standard setpoint source selected in 0x2860:001 (P201.01).
	1	Network setpoint
	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 (P400.17).	
CiA control word 0x6040	In case of control via the device profile CiA 402:	
• In operating mode "CiA: Velocity mode [2]", the setpoint speed defined via the "Set speed" 0x6042 (P781.00) parameter is used.		
• A changeover to an alternative setpoint source via the CiA control word is not possible.		

3.2.3 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 (P592.03)	Process input data: Network setpoint frequency (0.1) (Process data IN: Net.freq. 0.1) 0.0 ... [0.0] ... 599.0 Hz	Mappable parameter for specifying the frequency setpoint in [0.1 Hz] via network. <ul style="list-style-type: none"> • 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 (P592.04)	Process input data: Network setpoint speed (Process data IN: Net.setp. speed) 0 ... [0] ... 50000 rpm	Mappable parameter for specifying the setpoint as speed in [rpm] via network. <ul style="list-style-type: none"> • 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 (P592.05)	Process input data: Network setpoint frequency (0.01) (Process data IN: Net.freq. 0.01) 0.00 ... [0.00] ... 599.00 Hz	Mappable parameter for specifying the frequency setpoint in [0.01 Hz] via network. <ul style="list-style-type: none"> • 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 (P592.09)	Process input data: Torque scaling (Process data IN: Torque scaling) -128 ... [0] ... 127	Scaling factor for torque setpoint 0x400B:008 (P592.08) and actual torque value 0x400C:007 (P593.07) via network. <ul style="list-style-type: none"> • With the setting 0, no scaling takes place. Example: <ul style="list-style-type: none"> • Scaled actual torque value (0x400C:007) = 345 [Nm] • Scaling factor (0x400B:009) = 3 • Actual torque value = 345 [Nm] / 23 = 43.125 [Nm]
0x400B:012 (P592.12)	Process input data: Network setpoint frequency [0.02Hz] (Process data IN: NetSetfreq0.02Hz) -29950 ... [0] ... 29950 Hz	Mappable parameter for specifying the frequency setpoint in [0.02 Hz] via network. <ul style="list-style-type: none"> • The specification is made without sign (irrespective of the rotating direction). • The rotating direction is specified via the control word. • Examples: 50 = 1 Hz, 100 = 2 Hz
0x400B:013 (P592.13)	Process input data: Network frequency setpoint [+/-16384] (Process data IN: N.FrqSet+/-16384) -16384 ... [0] ... 16384	Mappable parameter for specifying the frequency setpoint via network. <ul style="list-style-type: none"> • $\pm 16384 = \pm 100\%$ Maximum frequency 0x2916 (P211.00)
0x400C:003 (P593.03)	Process output data: Frequency (0.1) (Process data OUT: Frequency (0.1)) • Read only: x.x Hz	Mappable parameter for the output of the actual frequency value in [0.1 Hz] via network. <ul style="list-style-type: none"> • 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 (P593.04)	Process output data: Motor speed (Process data OUT: Motor speed) • Read only: x rpm	Mappable parameter for the output of the actual value as speed in [rpm] via network. <ul style="list-style-type: none"> • 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 (P593.06)	Process output data: Frequency (0.01) (Process data OUT: Frequency 0.01) • Read only: x.xx Hz	Mappable parameter for the output of the actual frequency value in [0.01 Hz] via network. <ul style="list-style-type: none"> • 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 (P593.07)	Process output data: Torque scaled (Process data OUT: Torque scaled) • Read only	Mappable parameter for the output of the actual torque value in [Nm / $2^{\text{scaling factor}}$] via network. <ul style="list-style-type: none"> The scaling factor can be set in 0x400B:009 (P592.09). Actual torque value = scaled actual torque value (0x400C:007) / $2^{\text{scaling factor}}$ <p>Example:</p> <ul style="list-style-type: none"> Scaled actual torque value (0x400C:007) = 345 [Nm] Scaling factor (0x400B:009) = 3 Actual torque value = 345 [Nm] / 2^3 = 43.125 [Nm]
0x400C:008 (P593.08)	Process output data: Frequency [0.02 Hz] (Process data OUT: Frequency 0.02Hz) • Read only: Hz	Mappable parameter for the output of the actual frequency value in [0.02 Hz] via network. <ul style="list-style-type: none"> The output is effected without sign (irrespective of the rotating direction). The rotating direction is specified via the status word. Examples: 50 = 1 Hz, 100 = 2 Hz
0x400C:009 (P593.09)	Process output data: Frequency [±16384] (Process data OUT: Freq. [±16384]) • Read only	Mappable parameter for the output of the actual frequency value via network. <ul style="list-style-type: none"> ±16384 = ±100 % Maximum frequency 0x2916 (P211.00)

3.3. 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.

Process input data

Address	Designation	Info
0x400B:011 (P592.11)	Process input data: PID feedback	► Feedback of PID variable via network
0x4008:002 (P590.02)	Process input words: NetWordIN2	► Control digital outputs via network
0x4008:003 (P590.03)	Process input words: NetWordIN3	► Control analog outputs via network
0x4008:004 (P590.04)	Process input words: NetWordIN4	
0x4008:005 (P590.05)	Process input words: NetWordIN5	► Additive voltage impression via network

Process output data

Address	Designation	Info
0x400C:005 (P593.05)	Process output data: Drive status	► Drive status
0x2C49:003 (P711.03)	Position counter: Actual position	► Position counter
0x400A:002 (P591.02)	Process output words: NetWordOUT2	► Output messages of the "sequencer" function via network

3.3.1 Process input data

Feedback of PID variable via network

The feedback of the control variable (actual value) can also be initiated via the network for the process controller. In this case, the following mappable parameter is available.

Parameter

Address	Name / setting range / [default setting]	Information
0x400B:011 (P592.11)	Process input data: PID feedback (Process data IN: PID feedback) -300.00 ... [0.00] ... 300.00 PID unit	Mappable parameter for the feedback of the variable (actual value) via network. <ul style="list-style-type: none">Only effective with the selection "Network[5]" in 0x4020:002 (P600.02).

Related topics

► [Configuring the process controller](#)

3.3.1.1 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 (P590.02)	Process input words: NetWordIN2 (NetWordINx: NetWordIN2) 0x0000 ... [0x0000] ... 0xFFFF	Mappable data word for optional control of the digital outputs via network. Assignment of the digital outputs: <ul style="list-style-type: none">Relay: 0x2634:001 (P420.01) / selection [34] ... [49]Digital output 1: 0x2634:002 (P420.02) / selection [34] ... [49]Digital output 2: 0x2634:003 (P420.03) / 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](#)

3.3.1.2 Control analog outputs via network

The mappable data words NetWordIN3 and NetWordIN4 are available for controlling the analog outputs via the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x4008:003 (P590.03)	Process input words: NetWordIN3 (NetWordINx: NetWordIN3) 0.0 ... [0.0] ... 100.0 %	Mappable data word for optional control of an analog output via network. Assignment of the analog outputs: <ul style="list-style-type: none">Analog output 1: 0x2639:002 (P440.02) = "NetWordIN3 [20]"Analog output 2: 0x263A:002 (P441.02) = "NetWordIN3 [20]"

Address	Name / setting range / [default setting]	Information
0x4008:004 (P590.04)	Process input words: NetWordIN4 (NetWordINx: NetWordIN4) 0.0 ... [0.0] ... 100.0 %	Mappable data word for optional control of an analog output via network. Assignment of the analog outputs: <ul style="list-style-type: none"> • Analog output 1: 0x2639:002 (P440.02) = "NetWordIN4 [21]" • Analog output 2: 0x263A:002 (P441.02) = "NetWordIN4 [21]"

Related topics

► [Configure analog outputs](#)

3.3.1.3 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 (P590.05)	Process input words: NetWordIN5 (NetWordINx: NetWordIN5) -100.0 ... [0.0] ... 100.0 %	Mappable data word for optionally specifying an additive voltage setpoint via network. <ul style="list-style-type: none"> • 100 % = Rated voltage 0x2C01:007 (P320.07) • This value is used if "Network [3]" is selected in 0x2B13:002.

Related topics

► [Additive voltage impression](#)

3.3.2 Process output data

3.3.2.1. Drive status

The following mappable parameter is available for the output of the drive status via the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x400C:005 (P593.05)	Process output data: Drive status (Process data OUT: Drive status) <ul style="list-style-type: none">Read only	Mappable status word (Modbus Legacy Register 2003).
	0 Error (non-resettable) active	
	1 Fault active	
	2 Waiting for start	
	3 Identification not executed	
	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	
	16 Process controller sleep mode	

3.3.2.2 Output messages of the "sequencer" function via network

The mappable data word NetWordOUT2 is available to output messages of the "Sequencer" function via the network.

- An individual message (16 bit value) can be configured for each sequencer segment.
 - ▶ [Segment configuration](#)
- The NetWordOUT2 data word is set to the value set for the execution time of the segment.

Parameter

Address	Name / setting range / [default setting]	Information
0x400A:002 (P591.02)	Process output words: NetWordOUT2 (NetWordOUTx: NetWordOUT2) <ul style="list-style-type: none">Read only	Mappable data word for the output of messages of the "Sequencer" function via network. Configuration of the messages: <ul style="list-style-type: none">0x4026:008: NetWordOUT2 value for sequencer segment10x4027:008: NetWordOUT2 value for sequencer segment20x4028:008: NetWordOUT2 value for sequencer segment30x4029:008: NetWordOUT2 value for sequencer segment40x402A:008: NetWordOUT2 value for sequencer segment50x402B:008: NetWordOUT2 value for sequencer segment60x402C:008: NetWordOUT2 value for sequencer segment70x402D:008: NetWordOUT2 value for sequencer segment80x402E:008: NetWordOUT2 value for finalsegment
	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

- ▶ [Sequencer](#)

3.4 Parameter access monitoring (PAM)

The parameter access monitoring can be used as basic protection against a control loss of the inverter. Monitoring is triggered if a parameter write access to a certain index does not take place at regular intervals via the established communication connection.

Preconditions

This monitoring only works when the network control is activated.

Except for the keypad, the monitoring can be used for all communication connections, for instance:

- PC/Engineering Tool <--> inverter with USB module
- PC/Engineering Tool <--> inverter with WLAN module
- Controller <--> network <--> inverter with network option

Details

For monitoring purposes, a non-zero value must be written into the "Keep-alive register" [0x2552:002 \(P595.02\)](#) at regular intervals. The first write access with a non-zero value activates monitoring. The intervals between the write accesses must not be higher than the time-out time set in [0x2552:003 \(P595.03\)](#). If no parameter write access takes place within the time-out time, monitoring is triggered: The response selected in [0x2552:005 \(P595.05\)](#) takes place and the action selected in [0x2552:005 \(P595.05\)](#). In addition, the status bit 1 in [0x2552:006 \(P595.06\)](#) is set to "1".

The error status can be left by a normal "error reset". Since monitoring continues to be active and the time-out time is not reset by the error reset, the inverter immediately changes again to the error status. In order to prevent this, you have the following options:

- Restore communication exchange.**
- Set the monitoring response in [0x2552:004 \(P595.04\)](#) to "No response [0]" or "Warning [1]".**
- Change over to local or flexible control.**

Parameter

Address	Name / setting range / [default setting]	Information
0x2552:002 (P595.02)	Parameter access monitoring: Keep alive register (PAM monitoring: Keep alive reg.) 0 ... [0] ... 65535	Register for cyclic parameter write accesses for monitoring the communication link. <ul style="list-style-type: none"> • If the setting is non-zero, the monitoring is active. • In order that the monitoring is not tripped, a non-zero value has to be entered into this index at regular intervals. The temporal distances of the write accesses must not be higher than the time-out time set in 0x2552:003 (P595.03).
0x2552:003 (P595.03)	Parameter access monitoring: Time-out time (PAM monitoring: Time-out time) 0.0 ... [10.0] ... 6553.5 s	Maximum permitted time between two write accesses to the "keep-alive-register". In case of a time-out <ul style="list-style-type: none"> • the error response selected in 0x2552:004 (P595.04) is effected, • the action selected in 0x2552:005 (P595.05) is effected, • the status bit 1 in 0x2552:006 (P595.06) is set to "1".
0x2552:004 (P595.04)	Parameter access monitoring: Reaction (PAM monitoring: Reaction)	Selection of the response to the triggering of the parameter access monitoring. Associated error code: <ul style="list-style-type: none"> • 33045 0x8115 - Time-out (PAM)
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2552:005 (P595.05)	Parameter access monitoring: Action (PAM monitoring: Action)	Selection of the action to be executed if the parameter access monitoring is triggered.
	0 No action	
	1 Reserved	

Address	Name / setting range / [default setting]	Information
0x2552:006 (P595.06)	Parameter access monitoring: Parameter Access Monitoring-Status (PAM monitoring: PAM status) • Read only	Bit coded display of the status of parameter access monitoring.
	Bit 0 Monitoring activated	1 = parameter access monitoring is active.
	Bit 1 Timeout	1 = within the time-out time set in 0x2552:003 (P595.03) , no successful parameter write access to the "keep-alive register" 0x2552:002 (P595.02) was made.
	Bit 2 WLAN time-out	
0x2552:007 (P595.07)	Parameter access monitoring: WLAN reset time-out time (PAM monitoring: WLAN reset t.out) 0 ... [0] ... 65535 s	Time after which the WLAN network with the current settings of the WLAN parameters is restarted if no "keep alive" messages are received. • 0 s = function deactivated (no WLAN restart). • With a setting > 0 s and a time-out, the control units sets 0x2440 = "Restart with current values [1]".

3.5 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 processing 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 are set to the value "0".
	2 Reset control word	The RUN command is reset. All other parameters keep their current value.

3.6 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 suppression: 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 suppression: Entry 2 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:003	Alarm suppression: Entry 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:004	Alarm suppression: Entry 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:005	Alarm suppression: Entry 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:006	Alarm suppression: Entry 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:007	Alarm suppression: Entry 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:008	Alarm suppression: Entry 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:009	Alarm suppression: Entry 9 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	
0x285C:010	Alarm suppression: Entry 10 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	

3.7 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 organisation.
- 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 organisation: <http://www.can-cia.org>

3.7.1 Supported operating modes

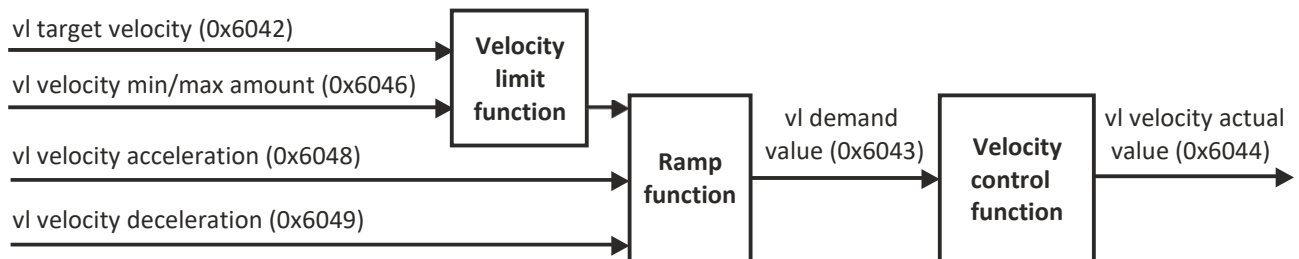
The inverter only supports the CiA 402 operating mode "CiA: Velocity mode".

Details

In the following, the steps required for configuring the operating mode "CiA: Velocity mode" are described.

1. Set the operating mode "CiA: Velocity mode [2]" in **0x6060 (P301.00)**.
2. Set speed is specified via the parameter "Set speed" **0x6042 (P781.00)**.
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" operating mode is now active and the inverter reacts to the setpoint speed specified via the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x6060 (P301.00)	CiA: Operation mode (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
	-1 MS: Torque mode	Vendor specific torque mode • Only possible in motor control type 0x2C00 (P300.00) = "Sensorless vector control (SLVC) [4]" or "Servo control (SC ASM) [2]". ▶ Configuring the torque control
	0 No selection	No selection
	2 CiA: Velocity mode	CiA: Velocity mode ▶ CiA 402 device profile
0x6061 (P788.00)	CiA: Active operation mode (Act. op. mode) • Read only	CiA: Active operation 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	CiA: Velocity mode

Address	Name / setting range / [default setting]		Information
0x6502 (P789.00)	Supported drive modes (Supported modes) • Read only		Bit coded display of the operating modes supported.
	Bit 0	Reserved	-
	Bit 1	CiA: Velocity mode	1 = CiA: velocity mode is supported.
	Bit 2	Reserved	-
	Bit 3	Reserved	
	Bit 5	Reserved	
	Bit 6	Reserved	
	Bit 7	Cyclic sync position mode	Always 0 (not supported).
	Bit 8	Cyclic sync velocity mode	
	Bit 9	Cyclic sync torque mode	
	Bit 17	MS: Velocity mode	1 = vendor specific velocity mode is supported.
	Bit 18	MS: Torque mode	- 1 = Manufacturer-specific torque mode.

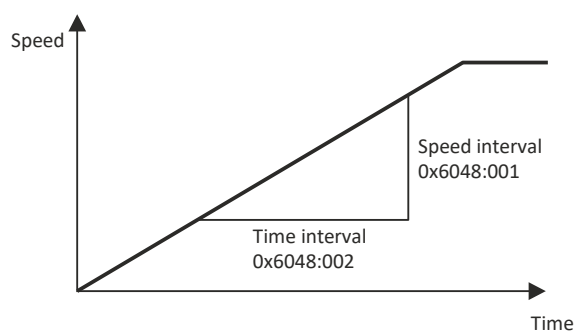
3.7.2 Basic setting

Set the following parameters.

Parameter

3.7.3 Process input data

The following diagram demonstrates the relationship of the parameters [0x6048:001 \(P785.01\)](#) and [0x6048:002 \(P785.02\)](#).



Parameter

Address	Name / setting range / [default setting]	Information
0x6042 (P781.00)	Set speed (Set speed) -32768 ... [0] ... 32767 rpm	Set speed (velocity mode).
0x6046:001 (P784.01)	Speed limits: Min. speed (Speed limits: Min. speed) 0 ... [0] ... 480000 rpm	Min. speed (velocity mode).
0x6046:002 (P784.02)	Speed limits: Max. speed (Speed limits: Max. speed) 0 ... [2147483647] ... 2147483647 rpm	Max. speed (velocity mode).
0x6048:001 (P785.01)	Acceleration ramp: CiA acceleration: Delta speed (Accel. ramp: Delta speed) 0 ... [3000] ... 2147483647 rpm	CiA acceleration: Delta speed
0x6048:002 (P785.02)	Acceleration ramp: CiA acceleration: Delta time (Accel. ramp: Delta time) 0 ... [10] ... 65535 s	CiA acceleration: Delta time
0x6049:001 (P786.01)	Deceleration ramp: CiA deceleration: Delta speed (Decel. ramp: Delta speed) 0 ... [3000] ... 2147483647 rpm	CiA deceleration: Delta speed
0x6049:002 (P786.02)	Deceleration ramp: CiA deceleration: Delta time (Decel. ramp: 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 (P325.00) The inverter does not support the CiA 402 torque mode.
0x60FF	Set speed -2147483648 ... [0] ... 2147483647 rpm	Setting of the set speed. • Alternative option for specifying the setpoint speed as a 32-bit value. • The parameter is only visible in connection with EtherCAT network.

3.7.4 Process output data

Parameter

Address	Name / setting range / [default setting]	Information
0x6043 (P782.00)	Internal set speed (Int. set speed) • Read only: x rpm	Display of the internal set speed (velocity demand).
0x6044 (P783.00)	Actual speed (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 (P325.00) .

3.7.5 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	0	X	X	X	X	1	1	0
Switch on	0	X	X	X	0	1	1	1
Enable operation	0	X	X	X	1	1	1	1
Activate quick stop	0	X	X	X	X	0	1	X
Disable operation	0	X	X	X	0	1	1	1
Pulse inhibit	0	X	X	X	X	X	0	X
Reset fault	0→1	X	X	X	X	X	X	X
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 14 Release holding brake	1 = release holding brake ⚠ CAUTION! <ul style="list-style-type: none"> 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 external trigger source for the "Release holding brake" command. ▶ Holding brake control

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.

3.7.5.1 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.

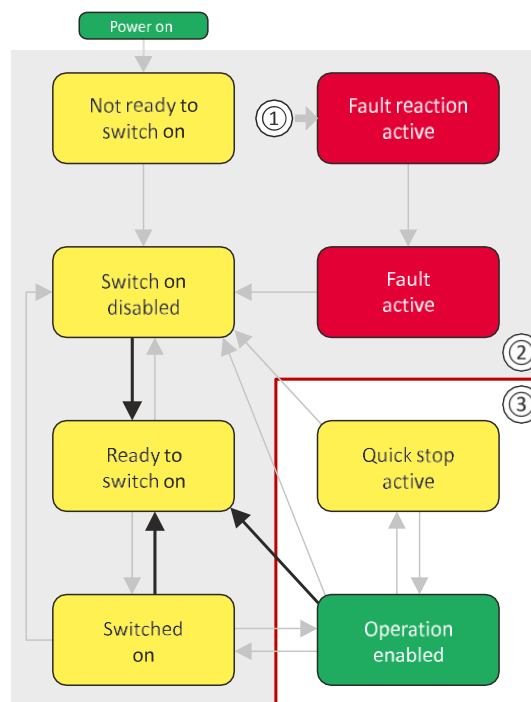
- If automatic brake operation is activated, the parameterized Brake closing time (0x2820:002 (P712.02)) is observed: The system waits until the brake is applied before the pulse inhibit is set. In the CiA 402 "CiA: Velocity mode", the Brake closing time is not observed.
- The motor has no torque.
- The device state "Switched on" or "Operation enabled" changes back to the "Ready to switch on" state.

! DANGER!

Uncontrolled movement

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.



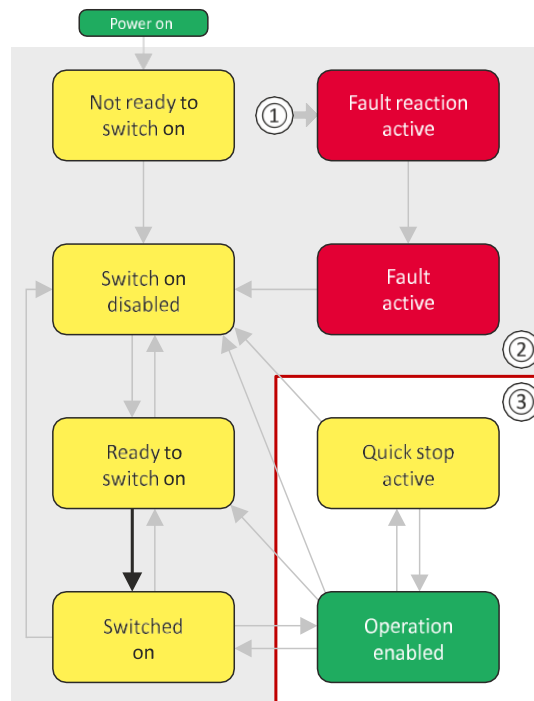
- 1 From all states
- 2 Power section disabled (pulse inhibit)
- 3 Power section enabled

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								

3.7.5.2 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.



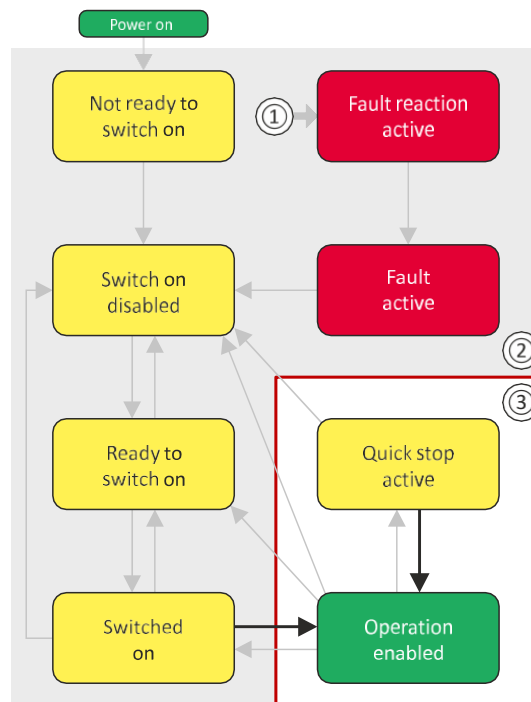
- 1 From all states
- 2 Power section inhibited (pulse inhibit)
- 3 Power section enabled

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								

3.7.5.3 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								

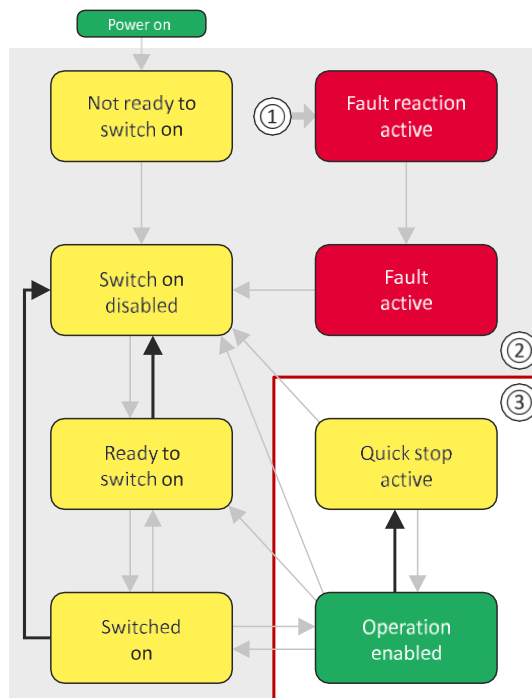
If the device status "Operation enabled" is signalled in the CiA status word, the inverter is ready to accept set points from the network master.

3.7.5.4 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 (P790.00)) 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

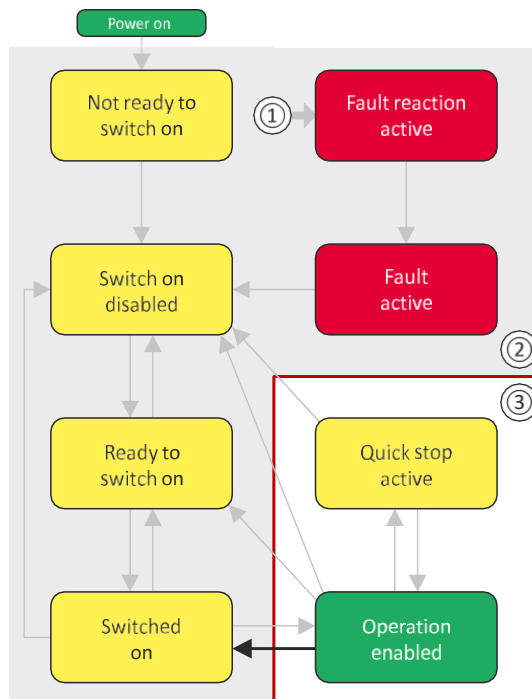
X = state is not relevant

- 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 (P324.00)) and the maximum torque (0x6072 (P326.00)) 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.

3.7.5.5 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 (P712.02)) 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

3.7.5.6 Pulse inhibit

This command disables the output stages of the inverter.

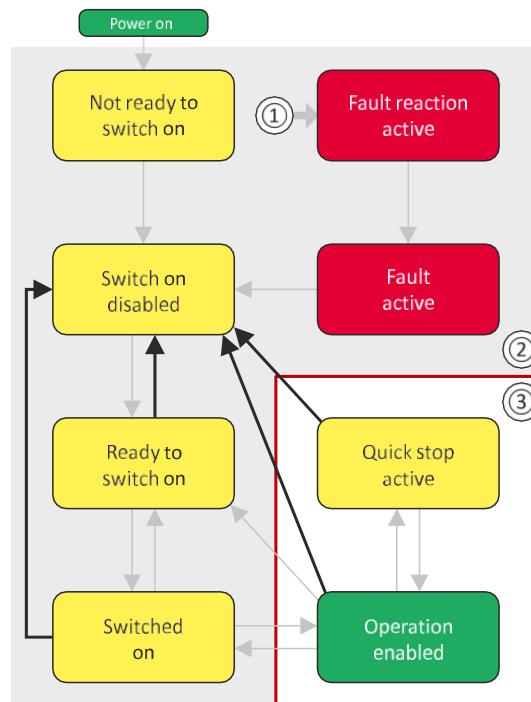
- The pulse inhibit is activated (pulses of the inverter are inhibited) if not already active.
- The motor has no torque.
- A changeover to the "Switch-on inhibited" device state takes place.

! DANGER!

Uncontrolled movement

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.



- 1 From all states
- 2 Power section inhibited (pulse inhibit)
- 3 Power section enabled

Bit pattern in the CiA control word (0x6040)

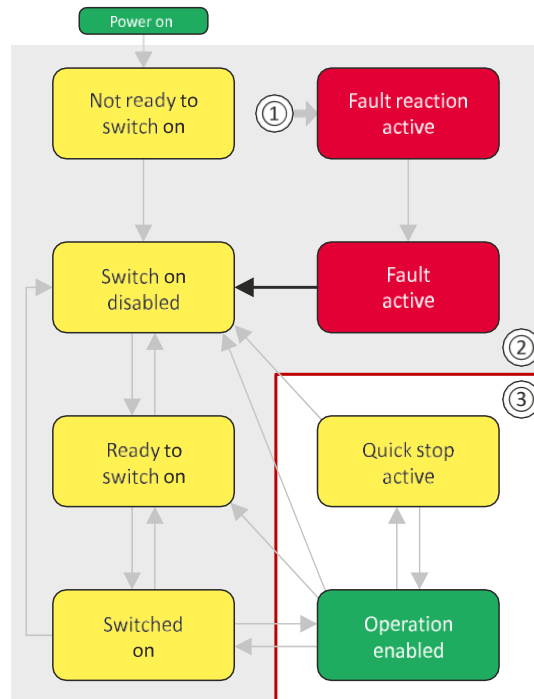
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Reset fault	Operating mode dependent			Operation enabled	Activate quick stop	Establish readiness for operation	Switch-on
X	0	X	X	X	X	X	0	X

X = state is not relevant

3.7.5.7 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								

3.7.6 Device states

[0x6041 \(P780.00\)](#) (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.

Detailed information on the various device states can be found in the following sections.

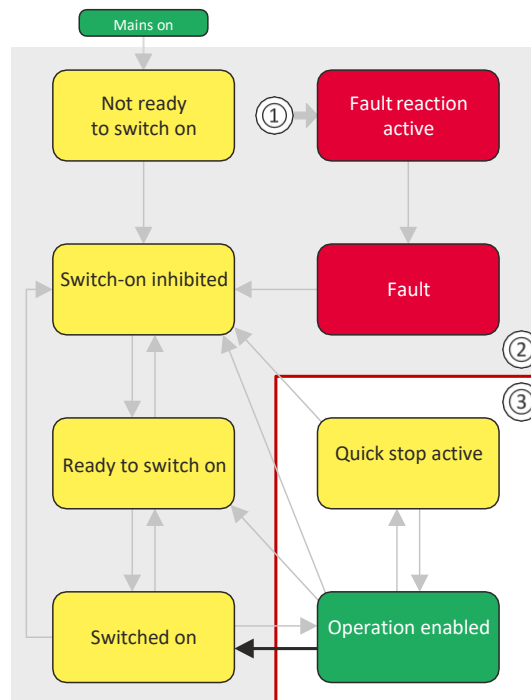
Parameter

Address	Name / setting range / [default setting]	Information
0x6041 (P780.00)	CiA status word (CiA status word) <ul style="list-style-type: none">• 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 8 RPDOs deactivated	1 = cyclic PDOs have been deactivated.
	Bit 9 CiA control enabled	1 = inverter can receive commands via network. <ul style="list-style-type: none">• Bit is not set in the operating mode 0x6060 (P301.00) = "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 14 Holding brake released	1 = holding brake released
	Bit 15 STO not active	0 = the inverter has been disabled by the integrated safety system 1 = the integrated safety system is not active Not available for i410 and i510 (always TRUE).

3.7.6.1 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

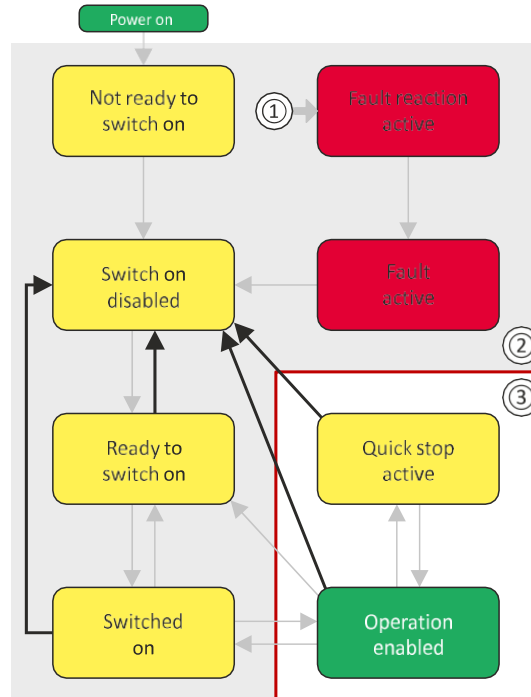
Bit pattern in the CiA status word (0x6041 (P780.00))								
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Warning active	Operation inhibited	Quick stop active	DC bus ready for operation	Fault active	Operation enabled	Switched on	Ready to switch on
X	X	0	X	X	0	0	0	0
X = state is not relevant								

3.7.6.2 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 [0x2824 \(P200.00\)](#) (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 \(P712.01\)](#)) 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 (P780.00))								
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

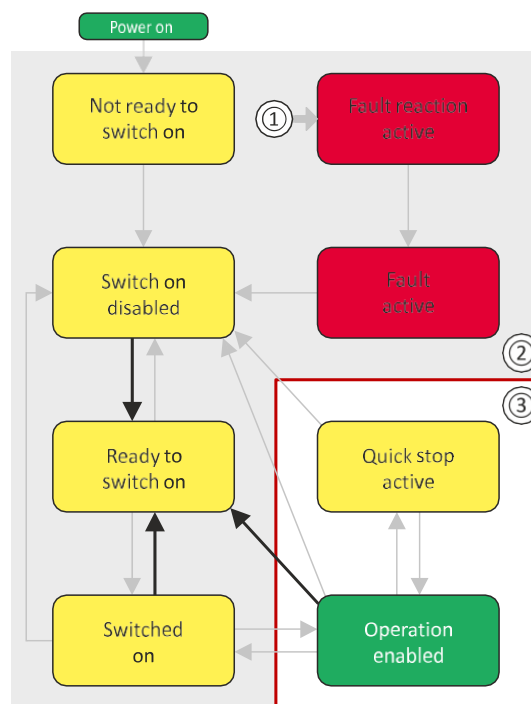
X = state is not relevant

3.7.6.3 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 **"**.

- 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 (P712.01)**) 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 (P780.00)**)

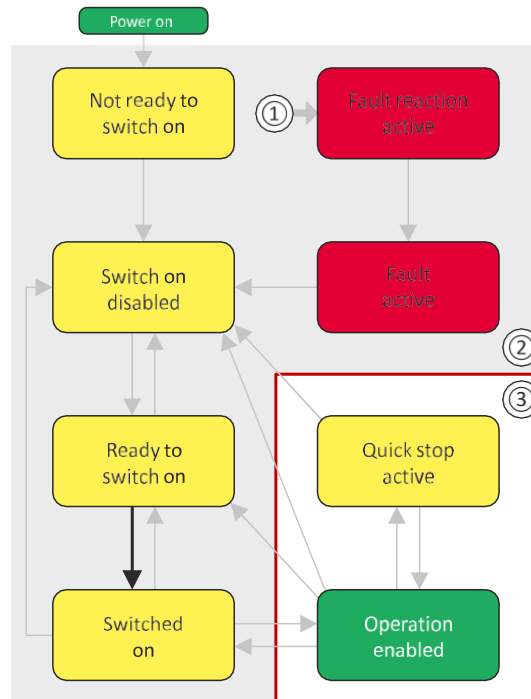
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Warning active	Operation inhibited	Quick stop active	DC bus ready for operation	Fault active	Operation enabled	Switched on	Ready to switch on
X	X	0	1	X	0	0	0	1

X = state is not relevant

3.7.6.4 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 parameterised.
- If the internal holding brake control (0x2820:001 (P712.01)) 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

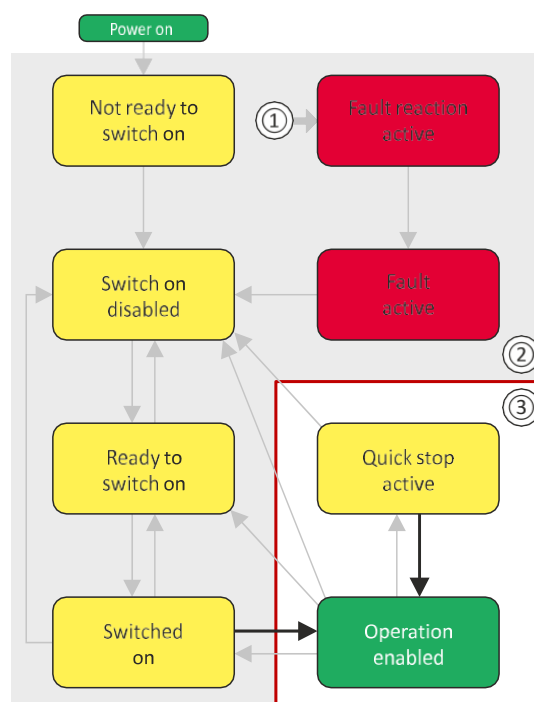
Bit pattern in the CiA status word (0x6041 (P780.00))								
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Warning active	Operation inhibited	Quick stop active	DC bus ready for operation	Fault active	Operation enabled	Switched on	Ready to switch on
X	X	1	1	X	0	0	1	1

X = state is not relevant

3.7.6.5 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 (P712.01) = 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 (P780.00))

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

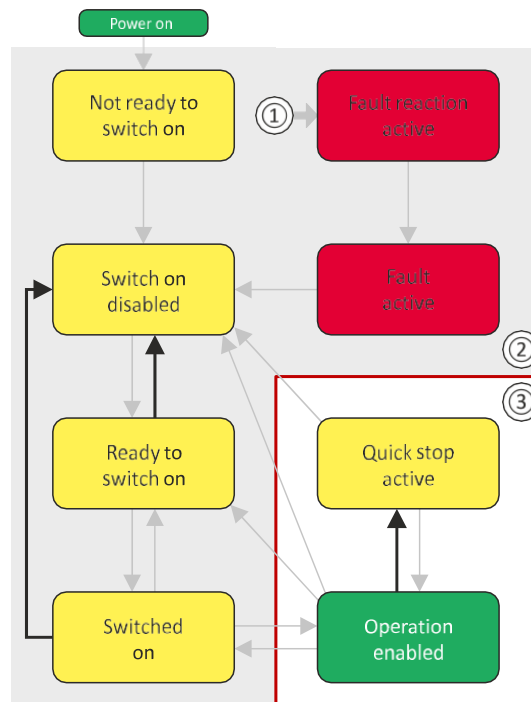
X = state is not relevant

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.

3.7.6.6 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 (P712.01)) 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 (P780.00))								
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.

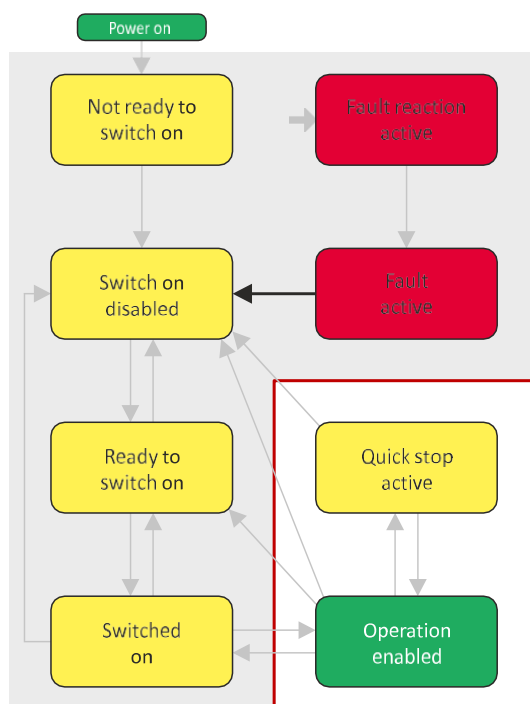
3.7.6.7 Fault reaction active

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 (P790.00)) 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 (P712.01)) 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 (P780.00))

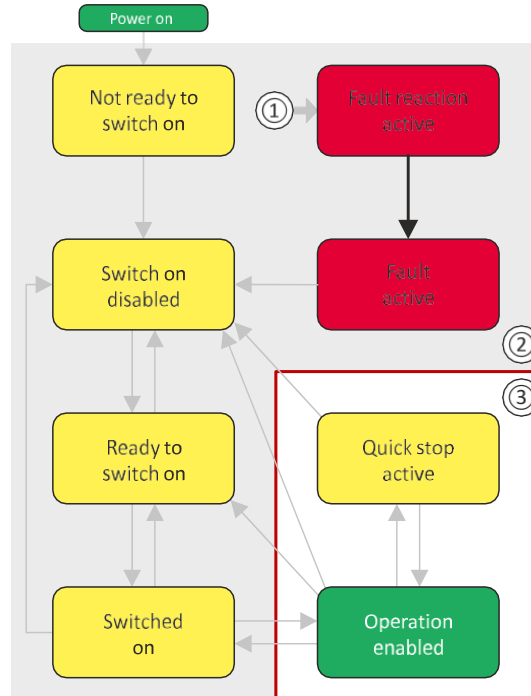
Bit 15 ... 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved (specific)	Warning active	Operation inhibited	Quick stop active	DC bus ready for operation	Fault active	Operation enabled	Switched on	Ready to switch on
X	X	0	X	X	1	1	1	1

X = state is not relevant

3.7.6.8 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 (P780.00))								
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.

3.7.6.9 STO (Safe Torque Off)

The status of the STO activity is included in bit 15 of the CiA status word ([0x6041 \(P780.00\)](#)).

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.

3.8 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 (P592.01)): 0x400B0110
- Mapping entry for the AC Drive status word (0x400C:001 (P593.01)): 0x400C0110
- Detailed information on the data mapping can be found in the chapter of the corresponding network.

3.8.1 AC drive control word

The AC drive control word (0x400B:001 (P592.01)) will only be processed if the network control in 0x2631:037 (P400.37) has been activated and the network is also active as the control source.

► Changing the control source during operation

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 (P592.01).

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 (P203.03).
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 (P592.01)	Process input data: AC Drive control word (Process data IN: AC control word) 0x0000 ... [0x0000] ... 0xFFFF	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 (P400.37) = "Network control active [114]": All bits of the AC Drive control word are evaluated. If bit 5 = "0" or 0x2631:037 (P400.37) = "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
	Bit 6 Activate network setpoint	0 = the standard setpoint source selected in 0x2860:001 (P201.01) is used. Bits are only evaluated if bit 5 = "1". 1 = network setpoint is used. For control without bit 5, the "Network setpoint active [116]" selection must be set in .
	Bit 12 Disable inverter	Bits are only evaluated if bit 5 = "1".
	Bit 13 Activate quick stop	
	Bit 14 Deactivate PID controlling	
	Bit 15 Activate DC braking	

3.8.2 AC drive status word Parameter

Address	Name / setting range / [default setting]	Information
0x400C:001 (P593.01)	Process output data: AC Drive status word (Process data OUT: AC status word) • Read only	Mappable status word with bit assignment in compliance with EtherNet/IP™ AC drive profile.
	Bit 0 Fault/Trip active	
	Bit 1 Warning active	
	Bit 2 Running forward	
	Bit 3 Running reverse	
	Bit 4 Ready	
	Bit 5 Network control active	
	Bit 6 Network setpoint active	
	Bit 7 At Reference	
	Bit 8 Profile-State bit 0	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)
	Bit 9 Profile-State bit 1	
	Bit 10 Profile-State bit 2	
	Bit 11 Profile-State bit 3	
	Bit 12 Process controller active	
	Bit 13 Torque mode active	
	Bit 14 Current limit reached	
	Bit 15 DC braking active	

3.9 CANopen



CANopen® is an internationally approved communication protocol which is designed for commercial and industrial automation applications. High data transfer rates in connection with efficient data formatting provide for the coordination of motion control devices in multi-axis applications.

- CANopen® is a registered community trademark of the CAN in Automation e.V user organisation.
- Detailed information on CANopen can be found on the web page of the CAN in Automation (CiA) user organisation: <http://www.can-cia.org>
- Information about the dimensioning of a CANopen network can be found in the configuration document for the inverter.

Preconditions

- The control unit (CU) of the inverter is provided with CANopen.
- The network is terminated by one bus terminating resistor each at the first and last physical node. See "Typical topologies".
- The DIP switches for node address, baud rate and bus terminating resistor are correctly set, see: [► Basic setting and options](#)
- The required EDS device description files for the inverters to be put into operation are loaded in the master (PLC).
 - [Download of EDS files](#)

Details

- The implementation of the CANopen communication profile (CiA DS301, version 4.02) enables baud rates of 20 kbps to 1 Mbps.
- For establishing a simple network connection, the inverter provides predefined control and status words for these profiles.

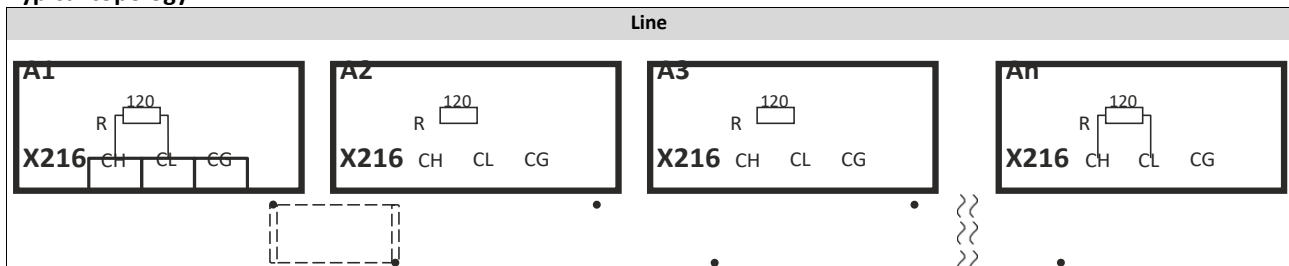
► [CiA 402 device profile](#)

► [AC drive](#)

There are also additional mappable data words to individually control the inverter:

- The inverter control is preconfigured via a CiA control word.

Typical topology



3.9.1 Commissioning

In the following, the steps required for controlling the inverter via CANopen are described.

Parameterization required

1. Set the CANopen node address.
 - Each network node must be provided with a unique node address.
 - Details: [▶ Node address setting](#)
2. Set the CANopen baud rate.
 - Default setting: 500 = kbit/s
 - Details: [▶ Baud rate setting](#)
3. Optional: Configure inverter as "mini master".
 - Required if the initialization of the CANopen network and the associated status change from "Pre-Operational" to "Operational" is not effected by a higher-level host system.
 - Details: [▶ Configuring the device as mini master](#)
4. Optional: Change the response of the inverter to the triggering of the RPDO time monitoring.
 - Default setting: In case of missing RPDOs, an error is triggered.
 - Details: [▶ Error responses](#)
5. Save parameter settings: **0x2022:003 (P700.03)** = "On / start = [1]".
6. Switch the inverter off and then on again in order that the changed communication settings can get effective.
7. Program the master so that the following SDO messages are sent to the inverter:
 1. **0x2631:037 (P400.37)** = 1 (activate network control)
 2. **0x2860:001 (P201.01)** = 5 (set network as standard setpoint source)
 3. PDO mapping and configuration of the process data objects RPDO1 and TPDO1 (see the sections "[RPDO1 mapping modification](#)" and "[TPDO1 mapping modification](#)").
8. Control inverter via RPDO1 (and evaluate the current status via TPDO1).
 - For assignment of the control word and setpoint selection, see section "[RPDO1 mapping modification](#)".
 - For assignment of the status word and actual value output, see section "[TPDO1 mapping modification](#)".
 - Acceleration **0x2917 (P220.00)** and deceleration **0x2918 (P221.00)** can be set/changed via SDO messages.



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](#)

3.9.2 RPDO1 mapping modification

The RPDO1 is used to control the inverter.

Changing the identifier (COB-ID) and the PDO mapping only allows the following procedure:

1. Set RPDO1 to "invalid": Set bit 31 in the identifier **0x1400:001 (P540.01)** = 1.
2. Set RPDO1 mapping to "invalid": set **0x1600:000** = 0
3. Map NetWordIN1 data word **0x4008:001 (P590.01)** to RPDO1:
set **0x1600:001** = 0x40080110.
4. Network setpoint frequency (0.1) **0x400B:003 (P592.03)** to RPDO1:
set **0x1600:002** = 0x400B0310.
5. Set RPDO1 mapping to "valid" again: set **0x1600:000** = 2 (number of mapped parameters).
6. Optional: Set timeout time for monitoring the data reception in **0x1400:005 (P540.05)** in [ms].
 - Default setting: 100 ms
7. Change identifier for RPDO1 (optional) and set RPDO1 to "valid" again: Write the new identifier into **0x1400:001 (P540.01)** and simultaneously set bit 31 to "0".
 - Default setting: 0x200 + node address (hex)
 - Example: Node address = 10 (0xA) and basic identifier = default setting:
Identifier to be written into = 0x200 + 0xA = 0x20A = (0b0011 0000 1010)

Function assignment of the NetWordIN1 data word (byte 1+2 of the RPDO1)

Bit	Default setting	For details and configuration, see
0	Not active (reserve)	0x400E:001 (P505.01)
1	Not active (reserve)	0x400E:002 (P505.02)
2	Activate quick stop	0x400E:003 (P505.03)
3	Not active (reserve)	0x400E:004 (P505.04)
4	Run forward (CW)	0x400E:005 (P505.05)
5	Activate preset (bit 0)	0x400E:006 (P505.06)
6	Activate preset (bit 1)	0x400E:007 (P505.07)
7	Reset error	0x400E:008 (P505.08)
8	Not active (reserve)	0x400E:009 (P505.09)
9	Activate DC braking	0x400E:010 (P505.10)
10	Not active (reserve)	0x400E:011 (P505.11)
11	Not active (reserve)	0x400E:012 (P505.12)
12	Reverse rotational direction	0x400E:013 (P505.13)
13	Not active (reserve)	0x400E:014 (P505.14)
14	Not active (reserve)	0x400E:015 (P505.15)
15	Not active (reserve)	0x400E:016 (P505.16)

Specifying the frequency setpoint (byte 3+4 of the RPDO1)

- The specification is made unsigned (independent of the direction of rotation) as integer in the resolution [0.1 Hz].
- The direction of rotation is defined in the default setting via bit 12 of the NetWordIN1 data word.
- Example: 456 = 45.6 Hz

3.9.3 TPDO1 mapping modification

The TPDO1 is used for the output of status information and the actual frequency value.

Changing the identifier (COB-ID) and the PDO mapping only allows the following procedure:

1. Set TPDO1 to "invalid": Set bit 31 in the identifier **0x1800:001 (P550.01)** = 1.
2. Set TPDO1 mapping to "invalid": set **0x1A00:000** = 0.
3. Map NetWordOUT1 data word **0x400A:001 (P591.01)** to TPDO1: set **0x1A00:001** = 0x400A0110.
4. Frequency (0.1) **0x400B:003 (P592.03)** to TPDO1: set **0x1A00:002** = 0x400C0310.
5. Set TPDO1 mapping to "valid" again: set **0x1A00:000** = 2 (number of mapped parameters).
6. Option: Transmission type in **0x1800:002 (P550.02)** Event timer in **0x1800:005 (P550.05)**.
 - Default setting: Cyclic transmission every 20 ms.
7. Change identifier for TPDO1 (optional) and set TPDO1 to "valid" again: Write the new identifier into **0x1800:001 (P550.01)** and simultaneously set bit 31 to "0".
 - Default setting: 0x40000180 + node address (hex)
 - Example: Node address = 10 (0xA) and TPDO1 basic identifier = default setting:

Identifier to be written into **0x1800:001 (P550.01)** = 0x40000180 + 0xA = 0x4000018A
(0b0100 0000 0000 0000 0000 0001 1000 1010)

Status assignment of the NetWordOUT1 data word (byte 1+2 of the TPDO1)

Bit	Default setting	For details and configuration, see
0	Ready for operation	0x2634:010 (P420.10)
1	Not connected	0x2634:011 (P420.11)
2	Operation enabled	0x2634:012 (P420.12)
3	Fault active	0x2634:013 (P420.13)
4	Not connected	0x2634:014 (P420.14)
5	Quick stop active	0x2634:015 (P420.15)
6	Running	0x2634:016 (P420.16)
7	Device warning active	0x2634:017 (P420.17)
8	Not connected	0x2634:018 (P420.18)
9	Not connected	0x2634:019 (P420.19)
10	Setpoint speed reached	0x2634:020 (P420.20)
11	Current limit reached	0x2634:021 (P420.21)
12	Actual speed = 0	0x2634:022 (P420.22)
13	Rotational direction reversed	0x2634:023 (P420.23)
14	Release holding brake	0x2634:024 (P420.24)
15	Inverter disabled (safety)	0x2634:025 (P420.25)

Output of the actual frequency value (byte 3+4 of the TPDO1)

- The output is made unsigned (independent of the direction of rotation) as integer in the resolution [0.1 Hz].
- An active reversal is displayed via bit 13 of the NetWordOUT1 data word.
- Example: 456 = 45.6 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) **0x2300 (P508.00)** Set = "Restart with current values [1]".

The following parameter can be used to restart or stop communication.

Optionally it is also possible to reset all communication parameters to the default status.

Parameter

Address	Name / setting range / [default setting]	Information
0x2300 (P508.00)	CANopen communication (CANopen comm.) <ul style="list-style-type: none"> Setting can only be changed if the inverter is disabled. 	Restart / stop communication. <ul style="list-style-type: none"> After successful execution, 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 default values	Restart communication with the standard values of the CAN parameters (0x1000 ... 0x1FFF and 0x2301).
	5 Stop network communication	Stop communication. <ul style="list-style-type: none"> The "Stop Remote Node" NMT command is executed. After successful execution of this command, only the reception of network management frames is possible.
	10 In progress	Only status feedback
	11 Action cancelled	
	12 Fault	

3.9.4 Basic setting and options

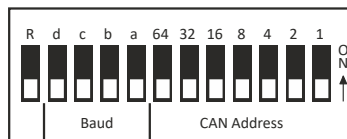
These settings are required to operate the inverter in the CANopen network:

- Activation of the bus terminating resistor if the inverter is integrated as the first or last physical node in the network.
 - ▶ [Activating the bus terminating resistor](#)
- Setting of a unique node address and the baud rate.
 - ▶ [Node address setting](#)
 - ▶ [Baud rate setting](#)
- Optional configuration of the inverter as a "mini-master".
 - ▶ [Configuring the device as mini master](#)

3.9.4.1 Activating the bus terminating resistor

If the inverter is the first or last physical node in the network, the bus terminating resistor must be activated using the DIP switch marked "R" on the device.

View of the DIP switch



3.9.4.2 Node address setting

Each network node must be provided with a unique node address.

Details

- The node address of the inverter can be optionally set in [0x2301:001 \(P510.01\)](#) or using the DIP switches on the device labelled with "1" ... "64".
- The setting that is active when the inverter is switched on is the effective setting.
- The labelling of the DIP switches corresponds to the values of the individual DIP switches for determining the node address (see the following example).
- The active node address is displayed in [0x2302:001 \(P511.01\)](#).

Example of how the node address is set via the DIP switches

DIP switch	64	32	16	8	4	2	1
Setting	OFF	OFF	ON	OFF	ON	ON	ON
Value	0	0	16	0	4	2	1
Node address	= sum of all values = 16 + 4 + 2 + 1 = 23						

Parameter

Address	Name / setting range / [default setting]	Information
0x2301:001 (P510.01)	CANopen settings: Node ID (CANopen sett.: Node ID) 1 ... [1] ... 127	Optionally setting of the node address (instead of setting via DIP switches 1 ... 64). <ul style="list-style-type: none">• The node address set here only becomes effective if DIP switches 1 ... 64 have been set to OFF before mains switching.• A change in the node address will not be effective until a CAN Reset Node is performed.

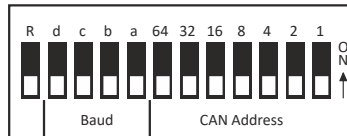
3.9.4.3 Baud rate setting

All network nodes must be set to the same baud rate.

Details

- The baud rate can be optionally set in [0x2301:002 \(P510.02\)](#) or using the DIP switches on the device labelled with "a" ... "d" (see the following table).
- The setting that is active when the inverter is switched on is the effective setting.
- The active baud rate is displayed in [0x2302:002 \(P511.02\)](#).

View of the DIP switch



d	c	b	a	Baud rate
OFF	ON	OFF	ON	20 kbps
OFF	OFF	ON	ON	50 kbps
OFF	OFF	ON	OFF	125 kbps
OFF	OFF	OFF	ON	250 kbps
OFF	OFF	OFF	OFF	500 kbps
OFF	ON	OFF	OFF	1 Mbps

When a combination is set that is not in the list, the baud rate is set to 500 kbps.

Parameter

Address	Name / setting range / [default setting]	Information
0x2301:002 (P510.02)	CANopen settings: Baud rate (CANopen sett.: Baud rate)	Optionally, setting of the baud rate (instead of setting via DIP switches a ... d). <ul style="list-style-type: none"> • The parameterised baud rate is only effective if DIP switches a ... d and 1 ... 64 were set to before mains switching. • A change in the baud rate will not be effective until a CAN reset node is performed.
	0 Automatic	
	1 20 kbps	
	2 50 kbps	
	3 125 kbps	
	4 250 kbps	
	5 500 kbps	
	6 800 kbps	
	7 1 Mbps	

3.9.4.4 Configuring the device as mini master

If the initialisation of the CANopen network and the associated status change from "Pre-Operational" to "Operational" is not effected by a master (PLC), the inverter can instead be defined as a "mini master" to execute this task.

Details

The inverter is configured as mini master in [0x2301:003 \(P510.03\)](#).

- In the default setting, the inverter is configured as slave and waits for the NMT telegram "Start Remote Node" from the master (PLC) in the "Pre-Operational" state after being switched on.
- Configured as mini master, the inverter changes to the "Operational" state after being switched on and sets all nodes connected to the CAN bus (broadcast telegram) to the "Operational" communication state using the "Start Remote Node" NMT telegram after the deceleration time set in [0x2301:004 \(P510.04\)](#) has elapsed. Only this communication status enables data exchange via the process data objects.



The change of the master/slave operation only becomes effective by renewed mains switching of the inverter or by sending the NMT telegram "Reset Node" or "Reset Communication" to the inverter. Alternatively, the CAN communication can be restarted via [0x2300 \(P508.00\)](#).

Parameter

Address	Name / setting range / [default setting]	Information
0x2301:003 (P510.03)	CANopen settings: Slave/Master (CANopen sett.: Slave/Master)	1 = after mains switching, inverter starts as mini-master.
	0 Slave	
	1 Mini-master	
0x2301:004 (P510.04)	CANopen settings: Start remote delay (CANopen sett.: Start rem. delay) 0 ... [3000] ... 65535 ms	If the inverter has been defined as mini-master, a delay time can be set here, which has to elapse after mains switching before the inverter deposits the "Start Remote Node" NMT telegram on the CAN bus.

3.9.3 Process data transfer

Process data objects (PDOs) are used for the cyclic transmission of (process) data via CANopen. PDOs only contain data and an identifier. They do not contain any information about the sender or receiver and are therefore very efficient.

Details

- Process data objects which the inverter receives via the network are referred to as "Receive PDOs" (RPDOs).
- Process data objects which the inverter sends via the network are referred to as "Transmit PDOs" (TPDOs).
- The maximum length of a PDO is 8 bytes (4 data words).
- Each PDO requires a unique identifier ("COB-ID") for the purpose of identification within the network.
- Communication parameters such as the transmission type and cycle time for each PDO can be set freely and independently of the settings of other PDOs

Transmission type

Process data objects can be transmitted in an event-controlled or time-controlled manner. The below table shows that it is possible to combine the different methods by means of logic operations (AND, OR):

- Event-controlled: The PDO is sent if a special device-internal event has occurred, for instance, if the data contents of the TPDO have changed or if a transmission cycle time has elapsed.
- Synchronous transmission: Transmission of a TPDOs or reception of an RPDO is effected after the inverter has received a sync telegram (COB-ID 0x80).
- Cyclic transmission: The cyclic transmission of PDOs is effected when the transmission cycle time has elapsed.
- Polled via RTR: Transmission of a TPDO is carried out on request by another device via data request frame (RTR remote transmit request). For this, the data requester (e.g. master) sends the data request frame with the COB-ID of the TPDO that is to be requested to transmit. The receiver recognises the RTR and carries out the transmission.

Transmission type	PDO transmission			Logic combination of different transmission types
	cyclic	synchronous	event-controlled	
0		■	■	AND
1 ... 240		■		-
254, 255	■		■	OR

Transmission type	Description
0	Synchronous and acyclic <ul style="list-style-type: none"> • The PDO is transmitted on an event-controlled basis with every sync (e.g. when a bit change occurs in the PDO).
1 ... 240	Synchronous and cyclic (sync-controlled with a response) <ul style="list-style-type: none"> • Selection $n = 1$: The PDO is transmitted with every sync. • Selection $1 < n \leq 240$: The PDO is transmitted with every n-th sync.
241 ... 251	Reserved
252	Synchronous - RTR only
253	Asynchronous - RTR only
254, 255	Asynchronous - manufacturer-specific / device profile-specific <ul style="list-style-type: none"> • If the value 255 is entered, sending and receiving takes place in the set cycle time. Linked signals are also sent and received every time the PDO is changed. The PDO is event-driven and cyclically transmitted. • If the value 254 is entered, sending and receiving takes place in the set cycle time. A change in the PDO linked signals has no influence.

Synchronisation of PDOs via sync telegram

During cyclic transmission, one or more PDOs are transmitted/received in fixed time intervals. An additional specific telegram, the so-called sync telegram, is used for synchronising cyclic process data.

- The sync telegram is the trigger point for the transmission of process data from the slaves to the master and for the acceptance of process data from the master in the slaves.
- For sync-controlled process data processing, the sync telegram must be generated accordingly.
- The response to a sync telegram is determined by the transmission type selected.

Generating the sync telegram:

- **0x1005** can be used to activate the generation of sync telegrams and to write the identifier value.
- Sync telegrams are created when bit 30 (see below) is set to "1".
- The interval between sync telegrams is to be set in **0x1006**.

Writing identifiers:

- To receive sync telegrams, the value 0x80 must be entered in the 11-bit identifier in the default setting (and in compliance with the CANopen specification). This means that all inverters are set to the same sync telegram by default.
- If sync telegrams are only to be received by specific nodes, their identifiers can be entered with a value of up to and including 0x07FF.
- The identifier can only be changed if the inverter does not send any sync telegrams (**0x1005**, Bit 30 = "0").

Data telegram assignment

8th byte (data 4)		7th byte (data 3)	6th byte (data 2)	5th byte (data 1)
Bit 31	Bit 30	Bit 29 ... bit 11		Bit 10 ... bit 0
x	0/1	Extended identifier*		11-bit identifier

* The extended identifier is not supported. Bit 11 ... bit 29 must be set to "0".

Parameter

Address	Name / setting range / [default setting]	Information
0x1005	COB-ID SYNC 0x00000000 ... [0x00000080] ... 0xFFFFFFFF	Identifier for sync telegram. How to change the identifier: 1. Deactivate Sync: Set bit 30 to "0". 2. Change identifier. 3. Activate Sync: Set bit 30 to "1".
0x1006	Communication cyclic period 0 ... [0] ... 65535000 us	Cycle time for sync telegrams. • With the setting "0", no sync telegrams are generated. • The set time is internally rounded up to the next multiple of 10 ms. The shortest possible cycle time thus is 10 ms.
0x1400:000	RPDO1 communication parameter: Highest sub-index supported • Read only	
0x1400:001 (P540.01)	RPDO1 communication parameter: COB-ID (RPDO1 config.: COB-ID) 0x00000000 ... [0x00000200] ... 0xFFFFFFFF	RPDO1: identifier How to change the identifier: 1. Set PDO to "invalid": Set bit 31 to "1". 2. Change identifier and reset PDO to "valid" (bit 31 = "0").
	Bit 0 COB-ID bit 0	
	Bit 1 COB-ID bit 1	
	Bit 2 COB-ID bit 2	
	Bit 3 COB-ID bit 3	
	Bit 4 COB-ID bit 4	
	Bit 5 COB-ID bit 5	
	Bit 6 COB-ID bit 6	
	Bit 7 COB-ID bit 7	
	Bit 8 COB-ID bit 8	
	Bit 9 COB-ID bit 9	
	Bit 10 COB-ID bit 10	
	Bit 31 PDO invalid	

Address	Name / setting range / [default setting]	Information
0x1400:002 (P540.02)	RPDO1 communication parameter: Transmission type (RPDO1 config.: Transm. type) 0 ... [255] ... 255	RPDO1: transmission type in compliance with DS301 V4.02
0x1400:005 (P540.05)	RPDO1 communication parameter: Event timer (RPDO1 config.: Event timer) 0 ... [100] ... 65535 ms	RPDO1: time-out for the monitoring of data reception.
0x1401:001 (P541.01)	RPDO2 communication parameter: COB-ID (RPDO2 config.: COB-ID) 0x00000000 ... [0x80000300] ... 0xFFFFFFFF	RPDO2: identifier How to change the identifier: 1. Set PDO to "invalid": Set bit 31 to "1". 2. Change identifier and reset PDO to "valid" (bit 31 = "0").
	Bit 0 COB-ID bit 0	
	Bit 1 COB-ID bit 1	
	Bit 2 COB-ID bit 2	
	Bit 3 COB-ID bit 3	
	Bit 4 COB-ID bit 4	
	Bit 5 COB-ID bit 5	
	Bit 6 COB-ID bit 6	
	Bit 7 COB-ID bit 7	
	Bit 8 COB-ID bit 8	
	Bit 9 COB-ID bit 9	
	Bit 10 COB-ID bit 10	
	Bit 31 PDO invalid	
0x1401:002 (P541.02)	RPDO2 communication parameter: Transmission type (RPDO2 config.: Transm. type) 0 ... [255] ... 255	RPDO2: transmission type in compliance with DS301 V4.02
0x1401:005 (P541.05)	RPDO2 communication parameter: Event timer (RPDO2 config.: Event timer) 0 ... [100] ... 65535 ms	RPDO2: time-out for the monitoring of data reception.
0x1402:001 (P542.01)	RPDO3 communication parameter: COB-ID (RPDO3 config.: COB-ID) 0x00000000 ... [0x80000400] ... 0xFFFFFFFF	RPDO3: identifier How to change the identifier: 1. Set PDO to "invalid": Set bit 31 to "1". 2. Change identifier and reset PDO to "valid" (bit 31 = "0").
	Bit 0 COB-ID bit 0	
	Bit 1 COB-ID bit 1	
	Bit 2 COB-ID bit 2	
	Bit 3 COB-ID bit 3	
	Bit 4 COB-ID bit 4	
	Bit 5 COB-ID bit 5	
	Bit 6 COB-ID bit 6	
	Bit 7 COB-ID bit 7	
	Bit 8 COB-ID bit 8	
	Bit 9 COB-ID bit 9	
	Bit 10 COB-ID bit 10	
	Bit 31 PDO invalid	
0x1402:002 (P542.02)	RPDO3 communication parameter: Transmission type (RPDO3 config.: Transm. type) 0 ... [255] ... 255	RPDO3: transmission type in compliance with DS301 V4.02
0x1402:005 (P542.05)	RPDO3 communication parameter: Event timer (RPDO3 config.: Event timer) 0 ... [100] ... 65535 ms	RPDO3: time-out for the monitoring of data reception.
0x1800:000	TPDO1 communication parameter: Highest sub-index supported • Read only	The value "5" is permanently set.

Address	Name / setting range / [default setting]	Information
0x1800:001 (P550.01)	TPDO1 communication parameter: COB-ID (TPDO1 config.: COB-ID) 0x00000001 ... [0x40000180] ... 0xFFFFFFFF	TPDO1: identifier How to change the identifier: 1. Set PDO to "invalid": Set bit 31 to "1". 2. Change identifier and reset PDO to "valid" (bit 31 = "0").
	Bit 0 COB-ID bit 0	
	Bit 1 COB-ID bit 1	
	Bit 2 COB-ID bit 2	
	Bit 3 COB-ID bit 3	
	Bit 4 COB-ID bit 4	
	Bit 5 COB-ID bit 5	
	Bit 6 COB-ID bit 6	
	Bit 7 COB-ID bit 7	
	Bit 8 COB-ID bit 8	
	Bit 9 COB-ID bit 9	
	Bit 10 COB-ID bit 10	
	Bit 30 RTR not allowed	
	Bit 31 PDO invalid	
0x1800:002 (P550.02)	TPDO1 communication parameter: Transmission type (TPDO1 config.: Transm. type) 0 ... [255] ... 255	TPDO1: transmission type in compliance with DS301 V4.02
0x1800:003 (P550.03)	TPDO1 communication parameter: Inhibit time (TPDO1 config.: Inhibit time) 0.0 ... [0.0] ... 6553.5 ms	TPDO1: minimum time between the transmission of two identical PDOs (see DS301 V4.02). • The set time between is internally rounded up to the next multiple of 10ms.
0x1800:005 (P550.05)	TPDO1 communication parameter: Event timer (TPDO1 config.: Event timer) 0 ... [20] ... 65535 ms	TPDO1: Cycle time for PDO transmission with transmission type "254" or "255". • The set time is internally rounded up to the next multiple of 10 ms.
0x1801:000	TPDO2 communication parameter: Highest sub-index supported • Read only	The value "5" is permanently set.
0x1801:001 (P551.01)	TPDO2 communication parameter: COB-ID (TPDO2 config.: COB-ID) 0x00000001 ... [0xC0000280] ... 0xFFFFFFFF	TPDO2: identifier How to change the identifier: 1. Set PDO to "invalid": Set bit 31 to "1". 2. Change identifier and reset PDO to "valid" (bit 31 = "0").
	Bit 0 COB-ID bit 0	
	Bit 1 COB-ID bit 1	
	Bit 2 COB-ID bit 2	
	Bit 3 COB-ID bit 3	
	Bit 4 COB-ID bit 4	
	Bit 5 COB-ID bit 5	
	Bit 6 COB-ID bit 6	
	Bit 7 COB-ID bit 7	
	Bit 8 COB-ID bit 8	
	Bit 9 COB-ID bit 9	
	Bit 10 COB-ID bit 10	
	Bit 30 RTR not allowed	
	Bit 31 PDO invalid	
0x1801:002 (P551.02)	TPDO2 communication parameter: Transmission type (TPDO2 config.: Transm. type) 0 ... [255] ... 255	TPDO2: transmission type in compliance with DS301 V4.02
0x1801:003 (P551.03)	TPDO2 communication parameter: Inhibit time (TPDO2 config.: Inhibit time) 0.0 ... [0.0] ... 6553.5 ms	TPDO2: minimum time between the transmission of two identical PDOs (see DS301 V4.02).
0x1801:005 (P551.05)	TPDO2 communication parameter: Event timer (TPDO2 config.: Event timer) 0 ... [0] ... 65535 ms	TPDO2: Cycle time for PDO transmission with transmission type "254" or "255". • The set time is internally rounded up to the next multiple of 10 ms.
0x1802:000	TPDO3 communication parameter: Highest sub-index supported • Read only	The value "5" is permanently set.

Address	Name / setting range / [default setting]	Information
0x1802:001 (P552.01)	TPDO3 communication parameter: COB-ID (TPDO3 config.: COB-ID) 0x00000001 ... [0xC0000380] ... 0xFFFFFFFF	TPDO3: identifier How to change the identifier: 1. Set PDO to "invalid": Set bit 31 to "1". 2. Change identifier and reset PDO to "valid" (bit 31 = "0").
	Bit 0 COB-ID bit 0	
	Bit 1 COB-ID bit 1	
	Bit 2 COB-ID bit 2	
	Bit 3 COB-ID bit 3	
	Bit 4 COB-ID bit 4	
	Bit 5 COB-ID bit 5	
	Bit 6 COB-ID bit 6	
	Bit 7 COB-ID bit 7	
	Bit 8 COB-ID bit 8	
	Bit 9 COB-ID bit 9	
	Bit 10 COB-ID bit 10	
	Bit 30 RTR not allowed	
	Bit 31 PDO invalid	
0x1802:002 (P552.02)	TPDO3 communication parameter: Transmission type (TPDO3 config.: Transm. type) 0 ... [255] ... 255	TPDO3: transmission type in compliance with DS301 V4.02
0x1802:003 (P552.03)	TPDO3 communication parameter: Inhibit time (TPDO3 config.: Inhibit time) 0.0 ... [0.0] ... 6553.5 ms	TPDO3: minimum time between the transmission of two identical PDOs (see DS301 V4.02).
0x1802:005 (P552.05)	TPDO3 communication parameter: Event timer (TPDO3 config.: Event timer) 0 ... [0] ... 65535 ms	TPDO3: Cycle time for PDO transmission with transmission type "254" or "255". • The set time is internally rounded up to the next multiple of 10 ms.
0x2301:006 (P510.06)	CANopen settings: COB-ID Configuration - PDO (CANopen sett.: COB-IDConfig PDO)	Selection of the process for assigning the identifiers. Irrespective of this selection, these are the following bits of the identifiers: • Bit 30: "RTR not allowed" (only in case of TPDO) • Bit 31: "PDO invalid"
	0 Base + node-ID	Identifier = set (basic) identifiers + set node address
	1 Freely configurable	Identifier = set identifiers
	2 Legacy base + node ID	Identifier = inherited (basic) identifier + set node address

3.9.3.1 Data mapping

Data mapping serves to define which process data are transmitted cyclically via the process data channels.

Details

Data mapping (in the case of CANopen also referred to as "PDO mapping") is preconfigured for control of the inverter via the device profile CiA 402:

- RPDO1 = **0x6040** (CiA control word) and **0x6042 (P781.00)** (Set speed).
- TPDO1 = **0x6041 (P780.00)** (CiA status word) and **0x6044 (P783.00)** (Actual speed).

Variable PDO mapping

The inverter supports variable PDO mapping for individual drive solutions. With 8 mapping entries each, 8-bit, 16-bit and 32-bit parameters can be assigned to a PDO in any order.



The total length of the mapped parameters must not exceed 8 bytes. The PDO mapping cannot be applied to all parameters. The mappable parameters are marked correspondingly in the parameter attribute list. [▶ Parameter attribute list](#)

The process of variable PDO mapping only allows the following procedure:

1. Set PDO to "invalid": set bit 31 in the corresponding identifier (0x1400:001 (P540.01)**)**

...
0x1402:001 (P542.01) or **0x1800:001 (P550.01)**
...
0x1802:001 (P552.01) to "1".

2. Set PDO mapping to "invalid": set subindex 0 in the mapping parameter (0x1600:000**)**

...
0x1602:000 or **0x1A00:000**
...
0x1A02:000 to "0".

3. Set desired PDO mapping via the corresponding mapping entries.

Format: 0xiiiiissll
(iiii = hexadecimal index,
ss = hexadecimal subindex,
ll = hexadecimal data length)

4. Set subindex 0 in the mapping parameter (0x1600:000**)**

...
0x1602:000 or **0x1A00:000**
...
0x1A02:000 to valid value (number of mapped parameters).

5. Set PDO back to "valid": set bit 31 in the corresponding identifier (0x1400:001 (P540.01)**)**

...
0x1402:001 (P542.01) or **0x1800:001 (P550.01)**
...
0x1802:001 (P552.01) to "0".

Parameter

Address	Name / setting range / [default setting]	Information
0x1600:000	RPDO1 mapping parameter: Number of mapped application objects in PDO 0 ... [2] ... 8	Number of objects mapped in RPDO1.
0x1600:001	RPDO1 mapping parameter: Application object 1 0x00000000 ... [0x60400010] ... 0xFFFFFFFF	Mapping entry 1 for RPDO1.
0x1600:002	RPDO1 mapping parameter: Application object 2 0x00000000 ... [0x60420010] ... 0xFFFFFFFF	Mapping entry 2 for RPDO1.
0x1600:003	RPDO1 mapping parameter: Application object 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for RPDO1.
0x1600:004	RPDO1 mapping parameter: Application object 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for RPDO1.

Address	Name / setting range / [default setting]	Information
0x1600:005	RPDO1 mapping parameter: Application object 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for RPDO1.
0x1600:006	RPDO1 mapping parameter: Application object 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for RPDO1.
0x1600:007	RPDO1 mapping parameter: Application object 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for RPDO1.
0x1600:008	RPDO1 mapping parameter: Application object 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for RPDO1.
0x1601:000	RPDO2 mapping parameter: Number of mapped application objects in PDO 0 ... [0] ... 8	Number of objects mapped in RPDO2.
0x1601:001	RPDO2 mapping parameter: Application object 1 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 1 for RPDO2.
0x1601:002	RPDO2 mapping parameter: Application object 2 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 2 for RPDO2.
0x1601:003	RPDO2 mapping parameter: Application object 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for RPDO2.
0x1601:004	RPDO2 mapping parameter: Application object 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for RPDO2.
0x1601:005	RPDO2 mapping parameter: Application object 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for RPDO2.
0x1601:006	RPDO2 mapping parameter: Application object 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for RPDO2.
0x1601:007	RPDO2 mapping parameter: Application object 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for RPDO2.
0x1601:008	RPDO2 mapping parameter: Application object 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for RPDO2.
0x1602:000	RPDO3 mapping parameter: Number of mapped application objects in PDO 0 ... [0] ... 8	Number of objects mapped in RPDO3.
0x1602:001	RPDO3 mapping parameter: Application object 1 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 1 for RPDO3.
0x1602:002	RPDO3 mapping parameter: Application object 2 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 2 for RPDO3.
0x1602:003	RPDO3 mapping parameter: Application object 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for RPDO3.
0x1602:004	RPDO3 mapping parameter: Application object 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for RPDO3.
0x1602:005	RPDO3 mapping parameter: Application object 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for RPDO3.
0x1602:006	RPDO3 mapping parameter: Application object 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for RPDO3.
0x1602:007	RPDO3 mapping parameter: Application object 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for RPDO3.
0x1602:008	RPDO3 mapping parameter: Application object 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for RPDO3.
0x1A00:000	TPDO1 mapping parameter: Number of mapped application objects in TPDO 0 ... [2] ... 8	Number of objects mapped in TPDO1.
0x1A00:001	TPDO1 mapping parameter: Application object 1 0x00000000 ... [0x60410010] ... 0xFFFFFFFF	Mapping entry 1 for TPDO1.
0x1A00:002	TPDO1 mapping parameter: Application object 2 0x00000000 ... [0x60440010] ... 0xFFFFFFFF	Mapping entry 2 for TPDO1.
0x1A00:003	TPDO1 mapping parameter: Application object 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for TPDO1.
0x1A00:004	TPDO1 mapping parameter: Application object 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for TPDO1.
0x1A00:005	TPDO1 mapping parameter: Application object 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for TPDO1.
0x1A00:006	TPDO1 mapping parameter: Application object 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for TPDO1.

Address	Name / setting range / [default setting]	Information
0x1A00:007	TPDO1 mapping parameter: Application object 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for TPDO1.
0x1A00:008	TPDO1 mapping parameter: Application object 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for TPDO1.
0x1A01:000	TPDO2 mapping parameter: Number of mapped application objects in TPDO 0 ... [0] ... 8	Number of objects mapped in TPDO2.
0x1A01:001	TPDO2 mapping parameter: Application object 1 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 1 for TPDO2.
0x1A01:002	TPDO2 mapping parameter: Application object 2 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 2 for TPDO2.
0x1A01:003	TPDO2 mapping parameter: Application object 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for TPDO2.
0x1A01:004	TPDO2 mapping parameter: Application object 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for TPDO2.
0x1A01:005	TPDO2 mapping parameter: Application object 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for TPDO2.
0x1A01:006	TPDO2 mapping parameter: Application object 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for TPDO2.
0x1A01:007	TPDO2 mapping parameter: Application object 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for TPDO2.
0x1A01:008	TPDO2 mapping parameter: Application object 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for TPDO2.
0x1A02:000	TPDO3 mapping parameter: Number of mapped application objects in TPDO 0 ... [0] ... 8	Number of objects mapped in TPDO3.
0x1A02:001	TPDO3 mapping parameter: Application object 1 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 1 for TPDO3.
0x1A02:002	TPDO3 mapping parameter: Application object 2 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 2 for TPDO3.
0x1A02:003	TPDO3 mapping parameter: Application object 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for TPDO3.
0x1A02:004	TPDO3 mapping parameter: Application object 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for TPDO3.
0x1A02:005	TPDO3 mapping parameter: Application object 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for TPDO3.
0x1A02:006	TPDO3 mapping parameter: Application object 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for TPDO3.
0x1A02:007	TPDO3 mapping parameter: Application object 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for TPDO3.
0x1A02:008	TPDO3 mapping parameter: Application object 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for TPDO3.

3.9.4 Parameter data transfer

Service data objects (SDOs) make it possible to read and write all parameters of the inverter via CANopen.

Details

- Two independent SDO channels are provided at the same time. SDO channel 1 is always active. SDO channel 2 can be activated via [0x2301:005 \(P510.05\)](#).
- An SDO is always transmitted with confirmation, i. e. the reception of an SDO frame is acknowledged by the receiver.
- The identifiers for SDO1 and SDO2 are generated from the basic identifier (in compliance with the "Predefined Connection Set") and the node address set:

Object	Direction		Identifier
	to the device	from the device	
SDO1	■		Basic identifier 0x600 + node address
		■	Basic identifier 0x580 + node address
SDO2	■		Basic identifier 0x640 + node address
		■	Basic identifier 0x5C0 + node address

Structure of the SDO frame user data

The user data are shown in Motorola format:

1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
Command	Index		Subindex	Data 1	Data 2	Data 3	Data 4
See table below.	LOW byte	HIGH byte		LOW word		HIGH word	
	Address of the parameter to be read or written.			LOW byte	HIGH byte	LOW byte	HIGH byte

The following commands can be transmitted or received for writing and reading the parameters:

Command	1st byte		Data length	Info
	hex	dec		
Write request	0x23	35	4 bytes	Writing of a parameter to the inverter.
	0x2B	43	2 bytes	
	0x2F	47	1 byte	
	0x21	33	Block	
Write response	0x60	96	4 bytes	Inverter acknowledges a write request.
Read request	0x40	64	4 bytes	Reading of a parameter from the inverter.
Read response	0x43	67	4 bytes	Inverter response to a read request with the current parameter value.
	0x4B	75	2 bytes	
	0x4F	79	1 byte	
	0x41	65	Block	
Error response	0x80	128	4 bytes	Inverter response to the incorrect execution of the read/write request.

More precisely, the command byte comprises the following information:

Command	1st byte							
	Command specifier (cs)			Toggle (t)	Length*		e	s
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Write request	0	0	1	0	0/1	0/1	1	1
Write response	0	1	1	0	0	0	0	0
Read request	0	1	0	0	0	0	0	0
Read response	0	1	0	0	0/1	0/1	1	1
Error response	1	0	0	0	0	0	0	0

*Bit coding of the length: 00 = 4 bytes, 01 = 3 bytes, 10 = 2 bytes, 11 = 1 byte
e: expedited (shortened block service)
s: segmented (normal block service)

More commands are defined in the DS301 V4.02 CANopen specification (e. g. segmented transfer).

Up to 4 bytes are available for parameter value entries. Depending on the data format, they are assigned as follows:

5th byte	6th byte	7th byte	8th byte
Parameter value (1 byte)	0x00	0x00	0x00
Parameter value (2 bytes)		0x00	0x00
LOW byte	HIGH byte		
Parameter value (4 bytes)			
LOW word		HIGH word	
LOW byte	HIGH byte	LOW byte	HIGH byte



The parameter attribute list in the annex also specifies a so-called “scaling factor”. The scaling factor is relevant to the transmission of parameter values which are represented with one or several decimal positions in the parameter list. If the scaling factor is > 1, the value must be multiplied with the scaling factor specified before the transmission, so that the value can be transferred completely (as an integer value). On the SDO client side, the integer value must then be divided by the scaling factor again, in order to receive the original value with decimal positions.

Parameter

Address	Name / setting range / [default setting]	Information
0x1200:000	SDO1 server parameter: Highest sub-index supported • Read only	
0x1200:001	SDO1 server parameter: COB-ID client > server (rx) • Read only	Display of the receive identifier for SDO server channel 1 (basic SDO channel). • According to DS301 V4.02, the basic SDO channel can neither be changed nor deactivated.
0x1200:002	SDO1 server parameter: COB-ID server > client (tx) • Read only	Display of the transmit identifier for SDO server channel 1 (basic SDO channel). • According to DS301 V4.02, the basic SDO channel can neither be changed nor deactivated.
0x1201:000	SDO2 server parameter: Highest sub-index supported • Read only	
0x1201:001	SDO2 server parameter: COB-ID client > server (rx) 0x00000000 ... [0x80000640] ... 0xFFFFFFFF	Specification of the receive identifier for SDO server channel 2. • If SDO server channel 2 is activated via 0x2301:005 (P510.05), this parameter is set to the value "node address + 0x640". This default setting can be changed.
0x1201:002	SDO2 server parameter: COB-ID server > client (tx) 0x00000000 ... [0x800005C0] ... 0xFFFFFFFF	Specification of the transmit identifier for SDO server channel 2. • If SDO server channel 2 is activated via 0x2301:005 (P510.05), this parameter is set to the value "node address + 0x5C0". This default setting can be changed.
0x1201:003	SDO2 server parameter: Node-ID of the SDO client 1 ... [0] ... 127	Specification of the node address for the SDO client.
0x2301:005 (P510.05)	CANopen settings: Activate SDO2 channel (CANopen sett.: SDO2 channel)	1 = activate SDO server channel 2.
	0 Not active 1 Active	
0x2301:007 (P510.07)	CANopen settings: COB-ID Configuration - SDO2 (CANopen sett.: COB-IDConfigSDO2)	1 = COB-ID configuration -SDO 2 freely configurable.
	0 Base + node-ID 1 Freely configurable	

3.9.5 Monitoring

3.9.5.1 Emergency telegram

If the error status changes when an internal device error occurs or is remedied, an emergency telegram is sent to the NMT master once.

Details

- The identifier for the emergency telegram is fixedly defined and is shown in [0x1014](#).
- In [0x1015](#), a blocking time can be set, in order to limit the bus load in the case of emergency telegrams following quickly in succession.

Parameter

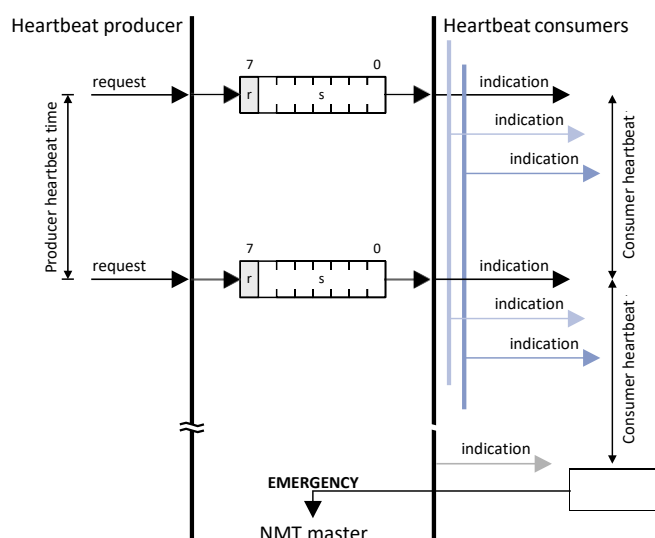
Address	Name / setting range / [default setting]	Information
0x1014	COB-ID Emergency telegram (EMCY) • Read only	Display of the identifier for emergency telegrams.
0x1015	Inhibit time EMCY 0.0 ... [0.0] ... 6553.5 ms	Blocking time which can be set in order to limit the bus load in the case of emergency telegrams following quickly in succession.

3.9.5.2 Heartbeat protocol

The heartbeat protocol can be used for node monitoring purposes within a CAN network.

Basic procedure

1. A heartbeat producer cyclically sends a heartbeat telegram to one or several receivers (consumers).
2. The consumer(s) monitor(s) the heartbeat telegram for arrival on a regular basis.



The inverter can be configured as producer or as consumer to monitor up to four other nodes.

Parameter

Address	Name / setting range / [default setting]	Information
0x1016:000 (P520.00)	Consumer heartbeat time: Highest sub-index supported (Cons. heartbeat: Highest subindex) • Read only	Highest subindex, permanently set to 4. Corresponds at the same time to the maximum possible number of nodes to be monitored.
0x1016:001 (P520.01)	Consumer heartbeat time: Consumer heartbeat time 1 (Cons. heartbeat: Cons. heartbeat1) 0x00000000 ... [0x00000000] ... 0x00FFFFFF	Node ID and heartbeat time of node 1 which is to be monitored. • Format: 0x00nnhhhh (nn = node ID, hhhh = heartbeat time in [ms])
0x1016:002 (P520.02)	Consumer heartbeat time: Consumer heartbeat time 2 (Cons. heartbeat: Cons. heartbeat2) 0x00000000 ... [0x00000000] ... 0x00FFFFFF	Node ID and heartbeat time of node 2 which is to be monitored. • Format: 0x00nnhhhh (nn = node ID, hhhh = heartbeat time in [ms])

Address	Name / setting range / [default setting]	Information
0x1016:003 (P520.03)	Consumer heartbeat time: Consumer heartbeat time 3 (Cons. heartbeat: Cons. heartbeat3) 0x00000000 ... [0x00000000] ... 0x00FFFFFF	Node ID and heartbeat time of node 3 which is to be monitored. • Format: 0x00nnhhhh (nn = node ID, hhhh = heartbeat time in [ms])
0x1016:004 (P520.04)	Consumer heartbeat time: Consumer heartbeat time 4 (Cons. heartbeat: Cons. heartbeat4) 0x00000000 ... [0x00000000] ... 0x00FFFFFF	Node ID and heartbeat time of node 4 which is to be monitored. • Format: 0x00nnhhhh (nn = node ID, hhhh = heartbeat time in [ms])
0x1017 (P522.00)	Producer heartbeat time (Prod. heartbeat) 0 ... [0] ... 65535 ms	Time interval for the transmission of the heartbeat telegram to the consumer(s). • The heartbeat telegram is sent automatically as soon as a time > 0 ms is set. • The set time is internally rounded up to the next multiple of 10 ms.

3.9.5.3 Error responses

The responses to CANopen errors such as missing PDOs or heartbeat frames can be configured via the following parameters.

Parameter

Address	Name / setting range / [default setting]	Information
0x1029:000	Error behavior: Highest sub-index supported • Read only	
0x1029:001	Error behavior: Communication error	Selection of the NMT state to which the inverter is to change automatically if a failure of a CANopen node or an internal error is detected in the "Operational" state. These also include the following communication errors: • Change-over of the CAN interface to the "Bus-off" state. • Occurrence of a "Heartbeat Event".
	0 Status > Pre-operational	In the "Pre-operational" state, network management, sync, and emergency telegrams as well as parameter data can be received; process data, however, are ignored.
	1 No status change	
	2 Status > Stopped	In the "Stopped" state, only network management telegrams can be received.
0x2857:001	CANopen monitoring: RPDO1-Timeout	Selection of the response to triggering the RPDO1 time monitoring. Associated error code: • 33425 0x8291 - CAN: RPDO1 time-out
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:002	CANopen monitoring: RPDO2-Timeout	Selection of the response to triggering the RPDO2 time monitoring. Associated error code: • 33426 0x8292 - CAN: RPDO2 time-out
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:003	CANopen monitoring: RPDO3-Timeout	Selection of the response to triggering the RPDO3 time monitoring. Associated error code: • 33427 0x8293 - CAN: RPDO3 time-out
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	

Address	Name / setting range / [default setting]	Information
0x2857:005	CANopen monitoring: Heartbeat-Timeout Consumer 1	Selection of the response with "Heartbeat Event" in consumer 1. Associated error code: • 33156 0x8184 - CAN: heartbeat time-out consumer 1
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:006	CANopen monitoring: Heartbeat-Timeout Consumer 2	Selection of the response with "Heartbeat Event" in consumer 2. Associated error code: • 33157 0x8185 - CAN: heartbeat time-out consumer 2
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:007	CANopen monitoring: Heartbeat-Timeout Consumer 3	Selection of the response with "Heartbeat Event" in consumer 3. Associated error code: • 33158 0x8186 - CAN: heartbeat time-out consumer 3
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:008	CANopen monitoring: Heartbeat-Timeout Consumer 4	Selection of the response with "Heartbeat Event" in consumer 4. Associated error code: • 33159 0x8187 - CAN: heartbeat time-out consumer 4
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:010	CANopen monitoring: "Bus-off" state change	Selection of the response to changing to the "Bus off" state. Associated error code: • 33154 0x8182 - CAN: bus off
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2857:011	CANopen monitoring: Warning	Selection of the response that is executed in the case of too many incorrectly sent or received CAN telegrams (> 96). Associated error code: • 33155 0x8183 - CAN: warning
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	



3.9.6 Diagnostics

3.9.6.1 LED status display

Information about the CAN bus status can be obtained quickly via the "CAN-RUN" and "CAN-ERR" LED displays on the front of the inverter.




The meaning can be seen from the tables below.

Inverter not active on the CAN bus (yet)




LED "CAN-RUN"	LED "CAN-ERR"	Meaning
off	off	Inverter is not active on the CAN bus.
	 on	"Bus Off" state.
		Automatic baud rate detection active.

Inverter active on the CAN bus

The green "CAN-RUN" LED indicates the CANopen state:

LED "CAN-RUN"	CANopen state
 blinking fast (5 Hz)	Pre-Operational
 on	Operational
 blinking 1x, then goes off for 1 s	Stopped

The red "CAN-ERR" LED indicates a CANopen error:

LED "CAN-ERR"	CANopen error
 blinking 1x, then goes off for 1 s	Warning Limit reached
 blinking 2x, then goes off for 1 s	Heartbeat Event
 blinking 3x, then goes off for 1 s	Sync message error (only possible in the "Operational" state)

3.9.6.2 Information on the network

The inverter has various diagnostic parameters for displaying ...

- the active node address, baud rate and current DIP switch settings;
- the network status, the CAN master status and the status of various time monitors;
- telegram counters.

The telegram counters are free-running, i. e. after reaching the maximum value , the respective counter starts again at 0.

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x1001	Error register • Read only	Bit-coded error status. • Bit 0 is set if an error is active. The other bits signalise which group the active error belongs to: • Bit 1: Current error • Bit 2: Voltage error • Bit 3: Temperature error • Bit 4: Communication error • Bit 5: Device profile-specific error • Bit 6: Reserved (always 0) • Bit 7: Manufacturer-specific error
0x2302:001 (P511.01)	Active CANopen settings: Active node ID (CANopen diag.: Active node ID) • Read only	Display of the active node address.

Address	Name / setting range / [default setting]	Information
0x2302:002 (P511.02)	Active CANopen settings: Active baud rate (CANopen diag.: Active baud rate) • Read only	Display of the active baud rate.
	0 Automatic	
	1 20 kbps	
	2 50 kbps	
	3 125 kbps	
	4 250 kbps	
	5 500 kbps	
	6 800 kbps	
	7 1 Mbps	
0x2303 (P509.00)	CANopen switch position (CANopen switch) • Read only	Display of the DIP switch setting at the last mains power-on.
0x2307 (P515.00)	CANopen time-out status (Time-out status) • Read only	Bit-coded status display of the CAN time monitoring functions.
	Bit 0 RPDO1-Timeout	1 = RPDO1 was not received within the monitoring time or not with the sync configured. • Status is reset automatically after the RPDO has been received again. • Setting of monitoring time for RPDO1 in 0x1400:005 (P540.05) .
	Bit 1 RPDO2-Timeout	1 = RPDO2 was not received within the monitoring time or not with the sync configured. • Status is reset automatically after the RPDO has been received again. • Setting of monitoring time for RPDO2 in 0x1401:005 (P541.05) .
	Bit 2 RPDO3-Timeout	1 = RPDO3 was not received within the monitoring time or not with the sync configured. • Status is reset automatically after the RPDO has been received again. • Setting of monitoring time for RPDO3 in 0x1402:005 (P542.05) .
	Bit 8 Heartbeat-Timeout Consumer 1	1 = within the "Heartbeat Consumer Time", no heartbeat telegram was received from node 1 to be monitored. • Status can only be reset by mains switching or error reset. • "Heartbeat Consumer Time" setting in 0x1016:001 (P520.01) .
	Bit 9 Heartbeat-Timeout Consumer 2	1 = within the "Heartbeat Consumer Time", no heartbeat telegram was received from node 2 to be monitored. • Status can only be reset by mains switching or error reset. • "Heartbeat Consumer Time" setting in 0x1016:002 (P520.02) .
	Bit 10 Heartbeat-Timeout Consumer 3	1 = within the "Heartbeat Consumer Time", no heartbeat telegram was received from node 3 to be monitored. • Status can only be reset by mains switching or error reset. • "Heartbeat Consumer Time" setting in 0x1016:003 (P520.03) .
	Bit 11 Heartbeat-Timeout Consumer 4	1 = within the "Heartbeat Consumer Time", no heartbeat telegram was received from node 4 to be monitored. • Status can only be reset by mains switching or error reset. • "Heartbeat Consumer Time" setting in 0x1016:004 (P520.04) .

Address	Name / setting range / [default setting]	Information
0x2308 (P516.00)	CANopen status (CANopen status) • Read only	Display of the current state.
	0 Initialisation	Initialisation active. • The initialisation is started automatically at mains connection. During this phase, the inverter is not involved in the data exchange process on the CAN bus. • All CAN-relevant parameters are initialised with the saved settings. • When the initialisation process has been completed, the inverter automatically adopts the "Pre-Operational" state.
	1 Reset node	"Reset Node" NMT command active. • All parameters are initialised with the saved settings (not only the CAN-relevant parameters).
	2 Reset communication	"Reset Communication" NMT command active. • Initialisation of all CAN-relevant parameters with the values stored.
	4 Stopped	Only network management telegrams can be received.
	5 Operational	Parameter data and process data can be received. If defined, process data is sent as well.
	127 Pre-Operational	Parameter data can be received, process data are ignored.
0x2309 (P517.00)	CANopen controller status (CAN contr.status) • Read only	Status display of the internal CANopen controller.
	1 Error active	The inverter is a fully-fledged communication node at the CANopen network. It is able to transmit and receive data and to report faults.
	2 Error passive	The inverter can only passively indicate faulty reception via the ACK field.
	3 Bus off	The inverter is electrically separated from the CANopen network. In order to exit this state, the CANopen interface must be reset. An automatic restart is implemented.
0x230A:000	CANopen statistics: Highest subindex • Read only	Number of frame and error counters.
0x230A:001 (P580.01)	CANopen statistics: PDO1 received (CAN statistics: PDO1 received) • Read only	Display of the number of PDO1 telegrams received.
0x230A:002 (P580.02)	CANopen statistics: PDO2 received (CAN statistics: PDO2 received) • Read only	Display of the number of PDO2 telegrams received.
0x230A:003 (P580.03)	CANopen statistics: PDO3 received (CAN statistics: PDO3 received) • Read only	Display of the number of PDO3 telegrams received.
0x230A:005 (P580.05)	CANopen statistics: PDO1 transmitted (CAN statistics: PDO1 transmitted) • Read only	Display of the number of PDO1 telegrams sent.
0x230A:006 (P580.06)	CANopen statistics: PDO2 transmitted (CAN statistics: PDO2 transmitted) • Read only	Display of the number of PDO2 telegrams sent.
0x230A:007 (P580.07)	CANopen statistics: PDO3 transmitted (CAN statistics: PDO3 transmitted) • Read only	Display of the number of PDO3 telegrams sent.
0x230A:009 (P580.09)	CANopen statistics: SDO1 telegrams (CAN statistics: SDO1 counter) • Read only	Display of the number of SDO1 telegrams.
0x230A:010 (P580.10)	CANopen statistics: SDO2 telegrams (CAN statistics: SDO2 counter) • Read only	Display of the number of SDO2 telegrams.
0x230B (P518.00)	CANopen error counter (CAN errorcounter) • Read only	Display of the total number of CAN faults that have occurred.

3.9.6.3 Device identification

For device identification in the network, the inverter provides the parameters listed in the following.

Parameter

Address	Name / setting range / [default setting]	Information
0x1000	Device type • Read only	CANopen device profile according CANopen specification CiA 301/ CiA 402. Specifies the axis type: <ul style="list-style-type: none">• 0x01010192 = single axis• 0x02010192 = double axis• 0x01020192 = servo single axis• 0x02020192 = servo double axis• 0x01030192 = stepper single axis• 0x02030192 = stepper double axis
0x1008	Manufacturer device name • Read only	Display of the manufacturer device name.
0x1009	Manufacturer hardware version • Read only	Display of the manufacturer hardware version.
0x100A	Manufacturer software version • Read only	Display of the manufacturer software version.
0x1018:001	Identity object: Vendor ID • Read only	Display of the manufacturer's identification number.
0x1018:002	Identity object: Product ID • Read only	Display of the product code of the inverter.
0x1018:003	Identity object: Revision number • Read only	Display of the main and subversion of the firmware.
0x1018:004	Identity object: Serial number • Read only	Display of the serial number of the inverter.

3.10 EtherCAT



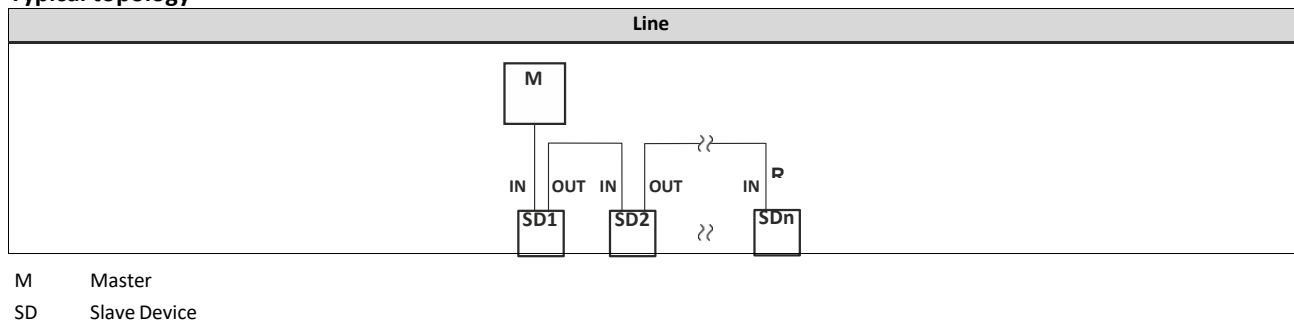
EtherCAT® (Ethernet for Controller and Automation Technology) is an Ethernet-based fieldbus system which fulfils the application profile for industrial realtime systems.

- 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.

Preconditions

- The control unit (CU) of the inverter is provided with EtherCAT.
- For commissioning, load the current device description files for EtherCAT devices via the »Package Manager« to your Engineering PC.

Typical topology



3.10.1 Commissioning

Preconditions

- The inverter is networked as EtherCAT slave to an EtherCAT master and, if necessary, further EtherCAT devices.
See "Typical topologies" under: [► EtherCAT](#)
- 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](#)
 - 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](#)

[► DC braking](#)

Details

- When using the »PLC Designers«, the CiA 402 operating mode "CiA: Velocity mode" is automatically activated.
- In the operating mode "CiA: Velocity mode", the set speed defined via the "Set speed" (0x6042 (P781.00)) 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 \(CiA 402 objects\)](#)
 - [► Process output data \(CiA 402 objects\)](#)
 - [► CiA 402 device profile](#)

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](#)

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. 1: 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 visualization 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.

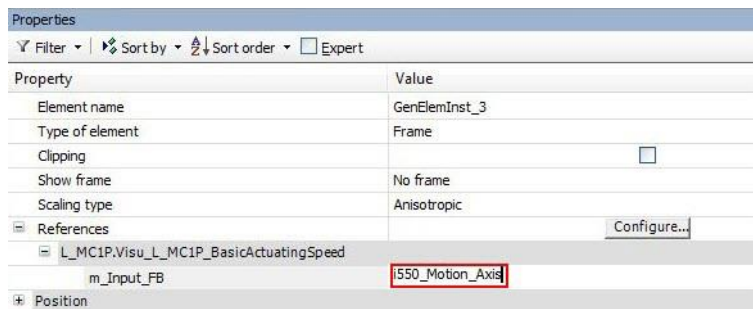


Fig. 2: Select reference

4. Adapt EtherCAT device to the application
 1. Select the axis movement of the i550.

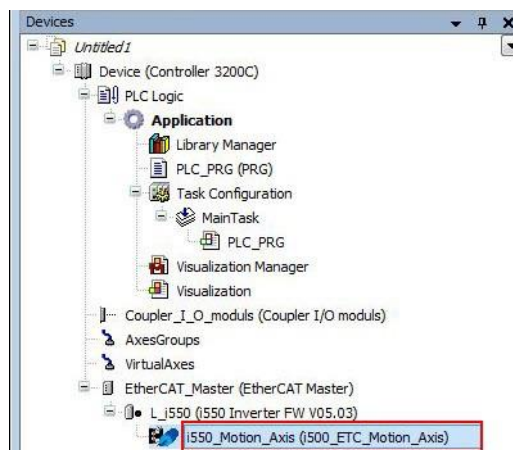


Fig. 3: Select i550

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 (P301.00)** = "CiA: Velocity mode [2]"
 - b) Function list: Start **0x2631:002 (P400.02)** = "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 (P508.00) Set = "Restart with current values [1]".**

Parameter

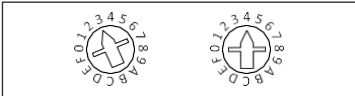
Address	Name / setting range / [default setting]	Information
0x2360 (P508.00)	EtherCAT communication (EtherCAT comm.)	Restart communication. <ul style="list-style-type: none">When the device command has been executed successfully, the value 0 is shown.
	0 No action/no error	Only status feedback
	1 Restart with current values	Restart communication with the current values.
	10 In process	Only status feedback
	11 Action cancelled	
	12 Fault	

3.10.2 Basic setting and options Addressing 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.

"Explicit Device Identification" via rotary encoder switch or parameter

"Explicit Device Identification" is required if the device is part of a "Hot Connect" group or the device is operated within a modular Lenze machine application. Each slave receives an *unambiguous* identifier for being identified by the master.

Setting	Assignment of the identifier
0x00	Identifier via the parameter 0x2361:004 (P510.04) .
0x01 ... 0xFF	Identifier via the rotary encoder switches. Example: Setting for the value 52 $(3 \times 16) + (4 \times 1) = 52$ <div style="text-align: center;"> x16 x1</div>

The value set via the rotary encoder switches is used once when the mains is switched on or after a network restart with **0x2360 (P508.00) = 1**. A changed value during operation will only become valid after the network has been restarted.

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 (P510.04)	EtherCAT settings: Device identifier (EtherCAT sett.: Device ident.) 0 ... [0] ... 65535	Setting of the identifier <i>unambiguous</i> in the network (Explicit Device Identification). This setting is only valid for rotary encoder switch setting 0 (0x00).

3.10.3 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" (0x6060 (P301.00) = 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":
 - ▶ [Standard mapping](#)
 - Mapping objects for a dynamic (free) assignment: ▶ [Dynamic \(free\) configuration](#)
- Mapping is executed in the master configuration and automatically transferred to the slave.
- The data format is 0xAAAABBCC (AAAA = index, BB = subindex, CC = length).

3.10.3.1 Standard mapping

Standard mapping of the RPDOs in the CiA 402 operating mode "CiA: Velocity mode"

Master → slave	
0x1603:001 RPDO mapping entry 1 (CiA: Velocity mode)	CiA control word (0x6040)
0x1603:002 RPDO mapping entry 2 (CiA: Velocity mode)	CiA 402 parameter "Set speed" (0x6042 (P781.00))
0x1605:001 RPDO mapping Entry 1 (freely configurable)	Not assigned.

Standard mapping of the TPDOs in the CiA 402 operating mode "CiA: Velocity mode"

Slave → master	
0x1A03:001 TPDO mapping entry 1 (CiA: Velocity mode)	CiA status word (0x6041 (P780.00))
0x1A03:002 TPDO mapping entry 2 (CiA: Velocity mode)	CiA 402 parameter "Actual speed" (0x6044 (P783.00))
0x1A03:003 TPDO mapping entry 3 (CiA: Velocity mode)	Error code (0x603F (P150.00))
0x1A05:001 TPDO mapping entry 1 (freely configurable)	Digital inputs

Parameter

Address	Name / setting range / [default setting]	Information
0x1603:001	RPDO (A) vl: Velocity mode (vl): RPDO (A) vl: Mapping Entry 1 • Read only	Predefined mapping entry 0x60400010 of "CiA control word" (0x6040) for the CiA 402 operating mode "CiA: Velocity mode".
0x1603:002	RPDO (A) vl: Velocity mode (vl): RPDO (A) vl: Mapping Entry 2 • Read only	Predefined mapping entry 0x60420010 of "Set speed" (0x6042 (P781.00)) for the CiA 402 operating mode "CiA: Velocity mode".
0x1A03:001	TPDO (A) vl: Velocity mode (vl): TPDO (A) vl: Mapping Entry 1 • Read only	Predefined mapping entry 0x60410010 of "CiA status word" (0x6041 (P780.00)) for the CiA 402 operating mode "CiA: Velocity mode".
0x1A03:002	TPDO (A) vl: Velocity mode (vl): TPDO (A) vl: Mapping Entry 2 • Read only	Predefined mapping entry 0x60440010 of "Actual speed" (0x6044 (P783.00)) for the CiA 402 operating mode "CiA: Velocity mode".
0x1A03:003	TPDO (A) vl: Velocity mode (vl): TPDO (A) vl: Mapping Entry 3 • Read only	Predefined mapping entry 0x603F0010 of "Error code" (0x603F (P150.00)) for the CiA 402 operating mode "CiA: Velocity mode".

3.10.3.2 Dynamic (free) configuration

The freely configurable mapping objects contain an 8-bit dummy entry (0x00050008). This ensures that each object is transferred cyclically with 16 bits.



In case of the freely configurable mapping objects, it is necessary to ensure that the total size of the PDO telegrams is always a multiple of 2 bytes (i.e. 2 bytes, 4 bytes, 6 bytes, 8 bytes etc.). For this "filling up" to a 16-bit structure, an 8-bit dummy entry is available (0x00050008). An odd size of the PDO telegram does not work with the EtherCAT bus (error message in the sync master of the EtherCAT master).

Parameter

Address	Name / setting range / [default setting]	Information
0x1605:000	RPDO (A) user: Free configuration: RPDO (A) user: Number of mapped objects in PDO • Read only	Number of mapping entries for RPDO (A) user.

Address	Name / setting range / [default setting]	Information
0x1605:001	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 1 • Read only	Mapping entry for the selection of an object to be received.
0x1605:002	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 2 • Read only	
0x1605:003	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 3 • Read only	
0x1605:004	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 4 • Read only	
0x1605:005	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 5 • Read only	
0x1605:006	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 6 • Read only	
0x1605:007	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 7 • Read only	
0x1605:008	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 8 • Read only	
0x1605:009	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 9 • Read only	
0x1605:010	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 10 • Read only	
0x1605:011	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 11 • Read only	
0x1605:012	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 12 • Read only	
0x1605:013	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 13 • Read only	
0x1605:014	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 14 • Read only	
0x1605:015	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 15 • Read only	
0x1605:016	RPDO (A) user: Free configuration: RPDO (A) user: Mapping Entry 16 • Read only	

Address	Name / setting range / [default setting]	Information
0x1A05:000	TPDO (A) user: Free configuration: TPDO (A) user: number of mapped objects • Read only	Number of mapping entries for TPDO (A) user.
0x1A05:001	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 1 • Read only	Mapping entry for the selection of an object to be sent.
0x1A05:002	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 2 • Read only	
0x1A05:003	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 3 • Read only	
0x1A05:004	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 4 • Read only	
0x1A05:005	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 5 • Read only	
0x1A05:006	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 6 • Read only	
0x1A05:007	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 7 • Read only	
0x1A05:008	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 8 • Read only	
0x1A05:009	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 9 • Read only	
0x1A05:010	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 10 • Read only	
0x1A05:011	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 11 • Read only	
0x1A05:012	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 12 • Read only	
0x1A05:013	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 13 • Read only	
0x1A05:014	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 14 • Read only	
0x1A05:015	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 15 • Read only	
0x1A05:016	TPDO (A) user: Free configuration: TPDO (A) user: Mapping Entry 16 • Read only	

3.10.3.3 Further communication objects

The parameters for the implemented EtherCAT objects are described below.

3.10.3.4 Expert settings

- The sync managers are configured for the cyclic data transfer and the mailbox communication (display in [0x1C00:001](#) ... [0x1C00:004](#)).
- For the communication, the I/O data mapping must be configured via ... [0x1C12:002](#) (for RPDOs) and ... [0x1C13:002](#) (for TPDOs).
- The basic settings for the sync managers are made via [0x1C32:001](#) ... [0x1C32:005](#) and [0x1C33:001](#) ... [0x1C33:005](#).

Parameter

Address	Name / setting range / [default setting]	Information
0x1C00:001	Sync manager type: SM0 communication type • Read only	The communication type SM1 is used for the mailbox input (MbxIn).
0x1C00:002	Sync manager type: SM1 communication type • Read only	The communication type SM2 is used for the mailbox output (MbxOut).
0x1C00:003	Sync manager type: SM2 communication type • Read only	The communication type SM3 is used for the input process data (RPDOs).
0x1C00:004	Sync manager type: SM3 communication type • Read only	The communication type SM4 is used for the output process data (TPDOs).
0x1C12:001	SM2 PDO assignment: PDO mapping object index of 1. assigned RPDO • Read only	Display of the mapping object index of RPDO1.
0x1C12:002	SM2 PDO assignment: PDO mapping object index of 2. assigned RPDO • Read only	Display of the mapping object index of RPDO2.
0x1C13:001	SM2 PDO assignment: PDO mapping object index of 1. assigned TPDO • Read only	Display of the mapping object index of TPDO1.
0x1C13:002	SM2 PDO assignment: PDO mapping object index of 2. assigned TPDO • Read only	Display of the mapping object index of TPDO2.
0x1C32:001	Sync Manager 2: Synchronization type • Read only	Settings of the synchronisation method for the mailbox communication.
0x1C32:002	Sync Manager 2: Cycle time • Read only: x ns	Display of the cycle time for the mailbox communication.
0x1C32:003	Sync Manager 2: Shift time • Read only: x ns	Display of the time shift for the mailbox communication.
0x1C32:004	Sync Manager 2: Sync modes supported • Read only	Display of the available synchronisation method for the mailbox communication. • Bit 0 (free run)
0x1C32:005	Sync Manager 2: Minimum cycle time • Read only: x ns	Display of the minimum cycle time for the mailbox communication.
0x1C33:001	Sync Manager 3: Synchronization type • Read only	Setting of the synchronisation method for the input process data (RPDO).
0x1C33:002	Sync Manager 3: Cycle time • Read only: x ns	Display of the cycle time for the input process data (RPDO).
0x1C33:003	Sync Manager 3: Shift time • Read only: x ns	Display of the time shift for the input process data (RPDO).
0x1C33:004	Sync Manager 3: Sync modes supported • Read only	Display of the available synchronisation method for the input process data (RPDO). • Bit 0 (free run)
0x1C33:005	Sync Manager 3: Minimum cycle time • Read only: x ns	Display of the minimum cycle time for the input process data (RPDO).

3.10.4 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](#)
 - [Process output data](#)
- 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.

3.10.5 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 applications 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 parameterization 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 »Remote Sinus« and stored permanently.**

Modifying parameters and permanently storing them.

1. Open »Remote Sinus«.

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.

3.10.6 Monitoring

The parameters for setting network monitoring functions are described below.

Parameter

Address	Name / setting range / [default setting]	Information
0x10F3:001	Diagnosis History: Maximum Messages • Read only	Maximum number of messages that can be stored in the history buffer (from subindex 6).
0x10F3:002	Diagnosis History: Newest Message • Read only	Subindex of the latest message.
0x10F3:003	Diagnosis History: Newest Acknowledged Message 0 ... [0] ... 255	Subindex of the latest message acknowledged by the EtherCAT master.
0x10F3:004	Diagnosis History: New Message Available • Read only	TRUE if messages are available that have not been acknowledged yet by the EtherCAT master.
0x10F3:005	Diagnosis History: Flags 0 ... [1] ... 65535	Settings for sending and saving of the messages.

Address	Name / setting range / [default setting]	Information
0x10F3:006	Diagnosis History: Diagnosis message 0 • Read only	
0x10F3:007	Diagnosis History: Diagnosis message 1 • Read only	
0x10F3:008	Diagnosis History: Diagnosis message 2 • Read only	
0x10F3:009	Diagnosis History: Diagnosis message 3 • Read only	
0x10F3:010	Diagnosis History: Diagnosis message 4 • Read only	
0x10F3:011	Diagnosis History: Diagnosis message 5 • Read only	
0x10F3:012	Diagnosis History: Diagnosis message 6 • Read only	
0x10F3:013	Diagnosis History: Diagnosis message 7 • Read only	
0x10F3:014	Diagnosis History: Diagnosis message 8 • Read only	
0x10F3:015	Diagnosis History: Diagnosis message 9 • Read only	
0x10F3:016	Diagnosis History: Diagnosis message 10 • Read only	
0x10F3:017	Diagnosis History: Diagnosis message 11 • Read only	
0x10F3:018	Diagnosis History: Diagnosis message 12 • Read only	
0x10F3:019	Diagnosis History: Diagnosis message 13 • Read only	
0x10F3:020	Diagnosis History: Diagnosis message 14 • Read only	
0x10F3:021	Diagnosis History: Diagnosis message 15 • Read only	
0x10F3:022	Diagnosis History: Diagnosis message 16 • Read only	
0x10F3:023	Diagnosis History: Diagnosis message 17 • Read only	
0x10F3:024	Diagnosis History: Diagnosis message 18 • Read only	
0x10F3:025	Diagnosis History: Diagnosis message 19 • Read only	
0x10F3:026	Diagnosis History: Diagnosis message 20 • Read only	

Address	Name / setting range / [default setting]	Information
0x10F3:027	Diagnosis History: Diagnosis message 21 • Read only	
0x10F3:028	Diagnosis History: Diagnosis message 22 • Read only	
0x10F3:029	Diagnosis History: Diagnosis message 23 • Read only	
0x10F3:030	Diagnosis History: Diagnosis message 24 • Read only	
0x10F3:031	Diagnosis History: Diagnosis message 25 • Read only	
0x10F3:032	Diagnosis History: Diagnosis message 26 • Read only	
0x10F3:033	Diagnosis History: Diagnosis message 27 • Read only	
0x10F3:034	Diagnosis History: Diagnosis message 28 • Read only	
0x10F3:035	Diagnosis History: Diagnosis message 29 • Read only	
0x10F3:036	Diagnosis History: Diagnosis message 30 • Read only	
0x10F3:037	Diagnosis History: Diagnosis message 31 • Read only	
0x2859:001 (P515.01)	EtherCAT monitoring: Watchdog elapsed (EtherCAT monit.: WD elapsed)	Selection of the response to the continuous interruption of communication to the EtherCAT master, e. g. by cable break or failure of the EtherCAT master. Associated error code: • 33168 0x8190 - Network: watchdog timeout
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:003 (P515.03)	EtherCAT monitoring: Invalid configuration (EtherCAT monit.: Invalid config)	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
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:004 (P515.04)	EtherCAT monitoring: Initialisation error (EtherCAT monit.: Init. error)	Selection of the response triggered by the occurrence of an error during the initialisation of the network component. Associated error code: • 33170 0x8192 - Network: initialisation error
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	





Address	Name / setting range / [default setting]		Information
0x2859:005 (P515.05)	EtherCAT monitoring: Invalid process data (EtherCAT monit.: Inval. proc.data)		Selection of the response triggered by the reception of invalid process data. Associated error code: • 33171 0x8193 - Network: invalid cyclic process data
	0	No response	▶ Error types
	1	Warning	
	2	Trouble	
	3	Fault	




3.10.7 Diagnostics

3.10.7.1 LED status display



Information on the network status can be obtained quickly via the "RUN" and "ERR" LED displays on the front of the inverter.

The meaning of the "RUN" and "ERR" LEDs can be obtained from the following two tables.

"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.

Notes on the EtherCAT connection status and the data transfer can be obtained via the LED "L/A" at the RJ45 sockets.

"L/A" LED	State	Meaning
off	Not connected	Network not available
 on	Connected	Network available No data transfer
 blinking	Traffic	Data transfer

3.12.6.2 Information on the network

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x2362:001 (P511.01)	Active EtherCAT settings: EoE IP address (EtherCAT diag.: EoE IP address) • Read only	
0x2362:002 (P511.02)	Active EtherCAT settings: EoE subnet mask (EtherCAT diag.: EoE subnet mask) • Read only	
0x2362:003 (P511.03)	Active EtherCAT settings: EoE gateway (EtherCAT diag.: EoE gateway) • Read only	
0x2362:004 (P511.04)	Active EtherCAT settings: Device identifier (EtherCAT diag.: Device ident.) • Read only	Display of the clear device address in the network which is defined via rotary encoder switch or object 0x2361:004 (P510.04) .
0x2362:005 (P511.05)	Active EtherCAT settings: EoE virtual MAC address (EtherCAT diag.: EoE virt MAC add) • Read only	

Address	Name / setting range / [default setting]	Information
0x2362:006 (P511.06)	Active EtherCAT settings: Station address (EtherCAT diag.: Station address) • Read only	Display of the active station address.
0x2362:007 (P511.07)	Active EtherCAT settings: Tx length (EtherCAT diag.: Tx length) • Read only	Display of the length of the transmitted cyclic data in bytes.
0x2362:008 (P511.08)	Active EtherCAT settings: Rx length (EtherCAT diag.: Rx length) • Read only	Display of the length of the received cyclic data in bytes.
0x2363 (P509.00)	EtherCAT switch position (EtherC. switch) • Read only	Display of the current rotary encoder switch settings.
0x2368 (P516.00)	EtherCAT status (EtherCAT status) • Read only	Display of the current network status.
	1 Initialisation	Network initialisation 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 (P517.00)	EtherCAT error (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	

3.10.7.3 Device identification

For device identification in the network, the inverter provides the EtherCAT objects listed in the following.

The objects can only be accessed via the EtherCAT network.

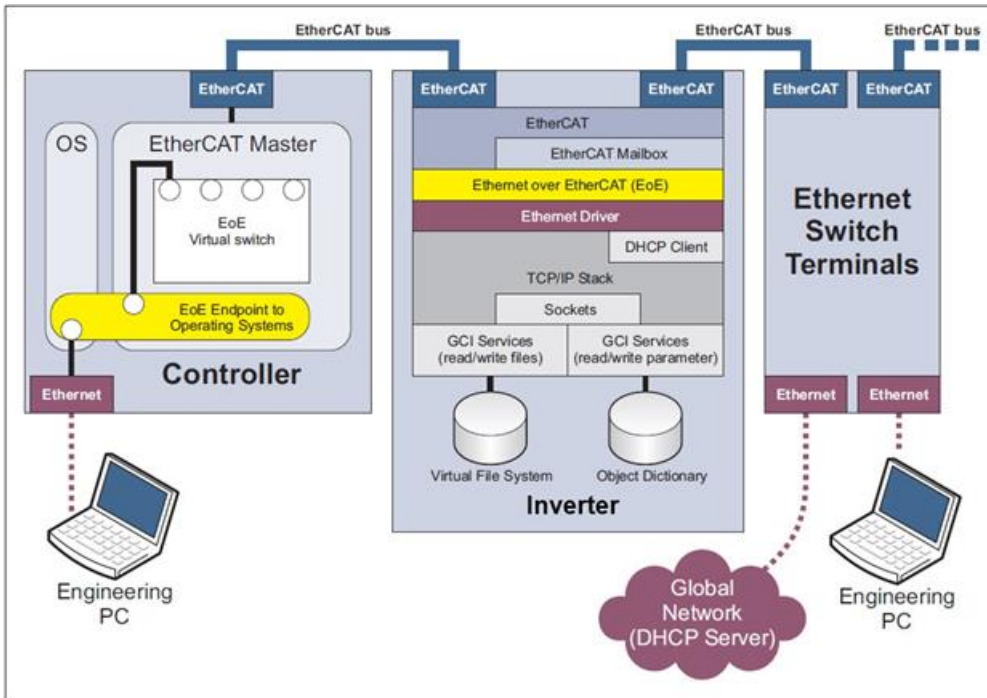
Parameter

Address	Name / setting range / [default setting]	Information
0x1000	Device type • Read only	CANopen device profile according CANopen specification CiA 301/ CiA 402.
0x1008	Manufacturer device name • Read only	Display of the manufacturer device name.
0x1009	Manufacturer hardware version • Read only	Display of the manufacturer hardware version.

Address	Name / setting range / [default setting]	Information
0x100A	Manufacturer software version • Read only	Display of the manufacturer software version.
0x1018:001	Identity object: Vendor ID • Read only	Display of the manufacturer's identification number.
0x1018:002	Identity object: Product Code • Read only	Display of the product code of the inverter.
0x1018:003	Identity object: Revision number • Read only	Display of the main and subversion of the firmware.
0x1018:004	Identity object: Serial number • Read only	Display of the serial number of the inverter.

3.10.8 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 »Remote Sinus«).



System architecture

Beckhoff controller	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 (P511.01)	Active EtherCAT settings: EoE IP address (EtherCAT diag.: EoE IP address) <ul style="list-style-type: none">• Read only	
0x2362:002 (P511.02)	Active EtherCAT settings: EoE subnet mask (EtherCAT diag.: EoE subnet mask) <ul style="list-style-type: none">• Read only	
0x2362:003 (P511.03)	Active EtherCAT settings: EoE gateway (EtherCAT diag.: EoE gateway) <ul style="list-style-type: none">• Read only	
0x2362:004 (P511.04)	Active EtherCAT settings: Device identifier (EtherCAT diag.: Device ident.) <ul style="list-style-type: none">• Read only	Display of the clear device address in the network which is defined via rotary encoder switch or object 0x2361:004 (P510.04) .
0x2362:005 (P511.05)	Active EtherCAT settings: EoE virtual MAC address (EtherCAT diag.: EoE virt MAC add) <ul style="list-style-type: none">• Read only	
0x2362:006 (P511.06)	Active EtherCAT settings: Station address (EtherCAT diag.: Station address) <ul style="list-style-type: none">• Read only	Display of the active station address.
0x2362:007 (P511.07)	Active EtherCAT settings: Tx length (EtherCAT diag.: Tx length) <ul style="list-style-type: none">• Read only	Display of the length of the transmitted cyclic data in bytes.
0x2362:008 (P511.08)	Active EtherCAT settings: Rx length (EtherCAT diag.: Rx length) <ul style="list-style-type: none">• Read only	Display of the length of the received cyclic data in bytes.

3.10.9 Automatic firmware download with Lenze Controller

The firmware of the inverter can be saved together with the »PLC Designer«-project. During start-up, the Lenze controller checks whether the firmware version in the inverter corresponds with the firmware version stored in the project for this device. If this is not the case, the controller loads the firmware version stored in the project to the inverter. In doing so, a "device replacement" can be ensured for service purposes, whereby the replacement device also functions with the same firmware version stored in the project, as the original device did previously.

Main version check

An automatic firmware download from the PLC to the inverter is only undertaken under the following conditions:

- Required firmware version 05.01.x.x or higher
- Identical main version 05.01.x.x in the inverter and in the PLC project
- Bootloader version 00.00.00.18 or higher

Main version check from firmware version 06.02.x.x

Restrictions from firmware version 06.02.x.x:

- There is no automatic firmware download if an inverter firmware version 05.x.x.x ("PLC Designer" project) has been stored on the Lenze controller and the replacement device contains firmware version 06.x.x.x in the "Device replacement" service case.
- The EtherCAT network remains in the "Pre-Operational" status if an inverter firmware version 06.x.x.x ("PLC Designer" project) has been stored on the Lenze controller and the replacement device contains firmware version 05.x.x.x in the "Device replacement" service case.

To get out of the "Pre-Operational" status, a manual intervention is required. For detailed information, refer to the commissioning document of the Lenze controller.

Restrictions

Power failure during firmware download: iCIF connection lost [33200]

In the event of a power failure, the inverter switches to a fault state. There is then only one means for recovery:

- **Load the firmware using the Firmware-Loader via the USB diagnostic module.**
- **Restart the inverter.**

It may occur that the inverter switches to a fault state after a successful firmware download.

Behavior after successful firmware download: Network: interruption of cyclic data exchange [33169]

- **Acknowledge the error via »PLC Designer« , »Remote Sinus« or via the mains switch.**

Engineering tool access during firmware download:

During the firmware download via the Controller, no simultaneous connection to an engineering tool shall be active (Remote Sinus / PLC Designer). In the event of an error, the is only one way to restore the connection:

- **Load the firmware with the firmware loader via the USB diagnostic module.**
- **Restart the inverter.**

3.11 EtherNet/IP



EtherNet/IP™ (EtherNet Industrial Protocol) is a fieldbus system based on Ethernet which uses the for data exchange.Common Industrial Protocol™ (CIP™)

- EtherNet/IP™ and Common Industrial Protocol™ (CIP™) are trademarks and patented technologies, licensed by the user organisation ODVA (Open DeviceNet Vendor Assoziation), USA.
- 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 configuration document 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](#)

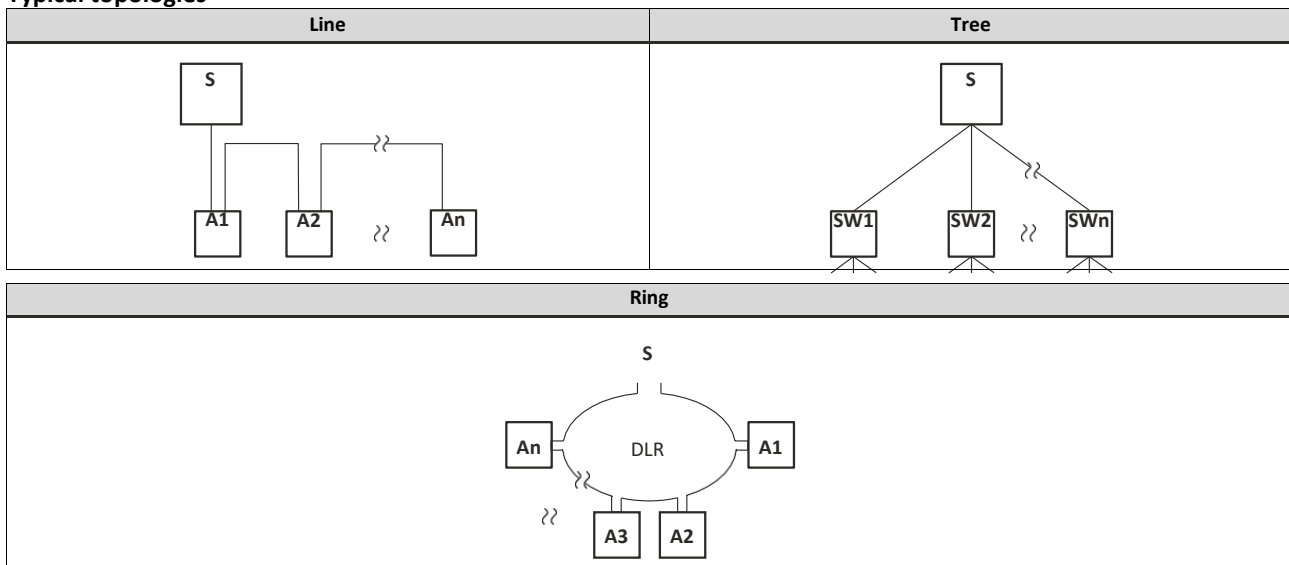
Registered trademarks used or trademarks of the Rockwell Automation® Corporation, USA:

- »RSLogix™«, »RSLogix™ 5000«
- »Allen-Bradley®«
- »CompactLogix™«, »ControlLogix®«, »SoftLogix™«

Preconditions

- The control unit (CU) of the inverter is provided with EtherNet/IP.

Typical topologies



S Scanner
A Adapter

SW Switch

3.11.1 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 (P592.01)):0x400B0110
- Mapping entry for the AC Drive status word (0x400C:001 (P593.01)):0x400C0110
- Detailed information on the data mapping can be found in the chapter of the corresponding network.

3.11.2 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.

0x01: Identity Object

The "Identity Object" provides the identification and the general information on the device.

Attribute (Instance ID)	Name
1	Vendor ID
2	Device Type
3	Product Code
4	Revision
5	Status
6	Serial Number
7	Product Name
8	State

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](#) (Implicit Messaging)
- ▶ [Parameter data transfer](#) (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 (P592.01) (some bits are masked) ▶ 0x400B:004 (P592.04) Network setpoint speed
21	Extended Speed Control Output	LSB of the AC-Drive control word 0x400B:001 (P592.01) ▶ 0x400B:004 (P592.04) Network setpoint speed
22	Speed and Torque Control Output	LSB of the AC Drive control word 0x400B:001 (P592.01) (some bits are masked) ▶ 0x400B:004 (P592.04) Network setpoint speed ▶ 0x400B:008 (P592.08) Torque mode setpoint
23	Extended Speed and Torque Control Output	LSB of the AC-Drive control word 0x400B:001 (P592.01) ▶ 0x400B:004 (P592.04) Network setpoint speed ▶ 0x400B:008 (P592.08) 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 (P593.01) (some bits are masked) ▶ 0x400C:004 (P593.04) Motor speed
71	Extended Speed Control Input	LSB of the AC-Drive status word 0x400C:001 (P593.01) ▶ 0x400C:004 (P593.04) Motor speed
72	Speed and Torque Control Input	LSB of the AC-Drive status word 0x400C:001 (P593.01) ▶ 0x400C:004 (P593.04) Motor speed ▶ 0x400C:007 (P593.07) Torque scaled
73	Extended Speed and Torque Control Input	LSB of the AC-Drive status word 0x400C:001 (P593.01) MSB Drive State of the AC Drive status word (mask bits 12 ... 15) ▶ 0x400C:004 (P593.04) Motor speed ▶ 0x400C:007 (P593.07) Torque scaled
Assembly object instances for customer specific configurations		
110	Custom Output	Customized
111	Custom Input	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.

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	Custom Input							
	...								
	31								

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 (P323.00) Rated motor current
7	Rated Voltage [V]	► 0x2C01:007 (P320.07) Rated voltage

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 (P592.01): Bit 0 (run forward, CW)
4	Run2	AC drive control word 0x400B:001 (P592.01): Bit 1 (run backward, CCW)
5	NetCtrl	AC Drive control word 0x400B:001 (P592.01): Bit 5 (activate network control: 0x2631:037 (P400.37) = 114)
6	State	AC drive status word 0x400C:001 (P593.01): Bits 8 ... 11 (profile status/Drive State) Bits 12 ... 15 masked
7	Running1	AC drive status word 0x400C:001 (P593.01): Bit 2 (run forward active, CW)
8	Running2	AC drive status word 0x400C:001 (P593.01): Bit 3 (run backward active, CCW)
9	Ready	AC drive status word 0x400C:001 (P593.01): Bit 4 (ready)
10	Faulted	AC drive status word 0x400C:001 (P593.01): Bit 0 (fault/trouble active)
11	Warning	AC drive status word 0x400C:001 (P593.01): Bit 1 (warning active)
12	FaultRst	AC drive control word 0x400B:001 (P592.01): Bit 2 (error reset)
13	FaultCode	Error code 0x603F (P150.00)
15	CtrlFromNet	AC drive status word 0x400C:001 (P593.01): Bit 5 (network control active)

Assignment of "CiA 402 plus States" to ""AC Drive Profile Drive States"

CiA 402 plus States	AC Drive Profile Drive States
INIT (0, 1)	0: Manufacturer-specific
NOT_READY_TO_SWITCH_ON (2)	1: Startup (drive initialization)
SWITCH_ON_DISABLED (3)	2: Not_Ready (mains voltage switched off)
READY_TO_SWITCH_ON (4)	3: Ready (mains voltage switched on)
SWITCHED_ON (5)	4: Enabled (drive has received run command)
OPERATION_ENABLED (6)	5: Stopping (drive has received stop command and is stopped)
DISABLE_OPERATION (7)	
SHUT_DOWN (8)	
QUICK_STOP (9)	6: Fault_Stop (drive is stopped due to a fault)
FAULT_REACTION_ACTIVE (10)	7: Faulted (faults have occurred)
FAULT (11)	

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 (P593.01): Bit 7 (At Reference)
4	NetRef	AC drive control word 0x400B:001 (P592.01): Bit 6 (activate network setpoint) Activate network setpoint: 0x2631:017 (P400.17) = 116
6	DriveMode	AC Drive mode 0x400B:010
7	SpeedActual [rpm / 2 ^{SpeedScale}]	Current motor speed 0x400C:004 (P593.04) A speed scale parameter is not supported.
8	SpeedRef [rpm / 2 ^{SpeedScale}]	Setpoint speed 0x400B:004 (P592.04) A speed scale parameter is not supported.
11	TorqueActual [Nm / 2 ^{TorqueScale}]	Current torque (scaled) 0x400C:007 (P593.07)
12	TorqueRef [Nm / 2 ^{TorqueScale}]	Torque setpoint 0x400B:008 (P592.08) The scaling factor can be set with 0x400B:009 (P592.09). Example: <ul style="list-style-type: none"> Torque setpoint (0x400B:008) = 345 [Nm] Scaling factor (0x400B:009) = 3 Scaled torque setpoint = 345 [Nm] / 2³ = 43.125 [Nm]
22	SpeedScale	Not implemented. Use the value "0" for SpeedScale .
24	TorqueScale	0x400B:009 (P592.09) = torque scaling of TorqueRef (0x400B:008 (P592.08)) and TorqueActual (0x400C:007 (P593.07))
29	RefFromNet	AC drive status word 0x400C:001 (P593.01): 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 (P301.00) CiA: Operation mode	0x2C00 (P300.00) Motor control mode	0x4020:001 (P600.01) 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

3.11.3 AC motor type

Parameter

Address	Name / setting range / [default setting]	Information
0x6402	Motor type	AC motor type <ul style="list-style-type: none"> Motor Data Object (0x28) - instance attribute 3
	3 PM synchronous	
	7 Squirrel cage induction	

3.11.4 Commissioning

In the following, the required steps are described to control the device as EtherNet/IP adapter.

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](#)
- 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.



An internal web server is supported. It can be accessed via the IP address defined in the parameter [0x23A1:001 \(P510.01\)](#). Protect access to the web server with e.g. a "firewall" and follow your internal IT security guidelines.



A firmware download from the PLC to the inverter via the network (also via FTP) only takes place under the following conditions:

- **Required firmware version 05.01.x.x or higher**
 - **Bootloader version 00.00.00.18 or higher**
-

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 (P510.01)**.

3. Set subnet mask: **0x23A1:002 (P510.02)**

4. Set gateway address: **0x23A1:003 (P510.03)**

The configuration of the IP communication is now completed.

2. Activate network control in the inverter.

1. Activate network control: **0x2631:037 (P400.37)** = "Network control active [114]"

2. Set network as standard setpoint source: **0x2860:001 (P201.01)** = "Network [5]"

If a different standard setpoint source is set and the network control is activated, a change-over to the network setpoint is possible via the AC Drive control word **0x400B:001 (P592.01)**.

The network control is now activated.

3. Save parameter settings: **0x2022:003 (P700.03)** = "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](#)

▶ [Customised configurations](#)

4. Configure the acyclic data transfer (Explicit Messaging).

▶ [Parameter data transfer](#)

The I/O configuration is now completed.

The configuration of the network is now completed.

Save the »RSLogix™« project and load the configuration into the PLC (scanner):

1. »RSLogix™« project must be saved.

Click "File" in the upper toolbar and execute the "Save" menu command.

If the project is saved for the first time, the "Save as" dialog box appears. Here, navigate to a folder, enter a filename, and click on "Save".

The configuration is saved in a file on your PC.

2. Load configuration into the scanner.

a) Click "Communications" in the upper toolbar and execute the "Download" menu command.

The "Download" dialog box is opened.

b) Click "Download".

The configuration is loaded into the scanner.

If the download has been completed successfully, »RSLogix™« changes to the online mode and the I/O-OK field in the upper left area of the screen is green.

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

In order that the inverter can be controlled via the network, activate the network control:
0x2631:037 (P400.37) = "Network control active [114]"

Select "Network [5]" in **0x2860:001 (P201.01)** 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 (P592.01)** 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 (P201.01) .
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 (P400.17) .	

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 (P201.01)**.
- Set the desired digital input in **0x2631:017 (P400.17)** 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 (P592.01)**/bit 5 = 1 and **0x2631:037 (P400.37)** = 114), all bits of the AC drive control word (**0x400B:001 (P592.01)**) are processed.

If the network control is not active (**0x400B:001 (P592.01)**/bit 5 = 0 or **0x2631:037 (P400.37)** = 0), the control bits 0, 1, 12, 13, 14, 15 are *not* processed. Their states are ignored and the drive is in local control.

Restart of 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:

- a) **Switch inverter off and on again.**
- b) **0x23A0 (P508.00) Set = "Restart with current values [1]".**

Parameter

Address	Name / setting range / [default setting]	Information
0x23A0 (P508.00)	EtherNet/IP communication (EtherN/IP comm.)	Restart / stop communication. <ul style="list-style-type: none"> 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.
	5 Stop network communication	Stop communication.
	10 In process	Only status feedback
	11 Action cancelled	
	12 Fault	

3.11.5 Basic setting and options



An internal web server is supported. It can be addressed via the IP address defined in the **0x23A1:001 (P510.01)** parameter. Protect access to the web server, e.g. with a firewall, and follow your internal IT security guidelines.

Parameter

Address	Name / setting range / [default setting]	Information
0x23A3 (P509.00)	EtherNet/IP switch position (EtherN. switch) <ul style="list-style-type: none"> Read only 	Display of the rotary encoder switch settings at the last mains power-on.
0x23A1:001 (P510.01)	EtherNet/IP settings: IP address (EtherN/IP sett.: 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
0x23A1:005 (P510.05)	EtherNet/IP settings: IP configuration (EtherN/IP sett.: 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 (P510.02)	EtherNet/IP settings: Subnet (EtherN/IP sett.: 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 = 0xFFFF → 0xFF.0xFF.0xFF.0x00 = 255.255.255.0
0x23A1:003 (P510.03)	EtherNet/IP settings: Gateway (EtherN/IP sett.: 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
0x23A1:004 (P510.04)	EtherNet/IP settings: Host name (EtherN/IP sett.: Host name)	Set host name. <ul style="list-style-type: none"> String with up to 64 characters.
0x23A1:006 (P510.06)	EtherNet/IP settings: Multicast TTL (EtherN/IP sett.: 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 (P510.07)	EtherNet/IP settings: Multicast allocation (EtherN/IP sett.: Mcast allocation)	Selection for multicast-IP addressing.
	0 Default allocation	
	1 Multicast number/start address	

Address	Name / setting range / [default setting]	Information
0x23A1:008 (P510.08)	EtherNet/IP settings: Multicast IP address (EtherN/IP sett.: Mcast IP addr.) 0.0.0.0 ... [239.64.2.224] ... 255.255.255.255	Set multicast IP address. The default setting 3221373167 corresponds to the Multicast IP address 239.64.2.192. • 3221373167 = 0xC00240EF → 0xEF.0x40.0x02.0xC0 = 239.64.2.192
0x23A1:009 (P510.09)	EtherNet/IP settings: Multicast number (EtherN/IP sett.: Multicast number) 1 ... [1] ... 8	Set multicast number.
0x23A4:001 (P512.01)	Port settings: Port 1 (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 (P512.02)	Port settings: Port 2 (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	
0x23A7 (P514.00)	Address conflict detection (AddrConflictDetec)	Activate address conflict detection (ACD) (enable). • If this value is changed, the device must be reset ("Power off/on" or "Type 0 Reset").
	0 Disabled	
	1 Enabled	
0x400B:010	Process input data: AC Drive mode	Selection of the AC drive mode.
	0 Vendor specific	
	1 Speed control (open loop)	
	2 Speed control (closed loop)	
	3 Torque control	

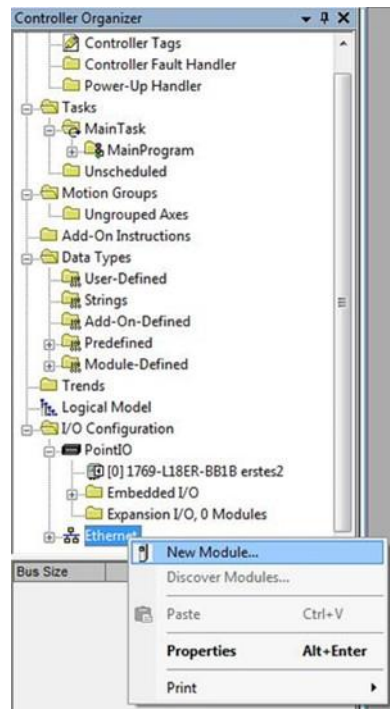
3.11.6 Process data transfer

Implicit Messaging

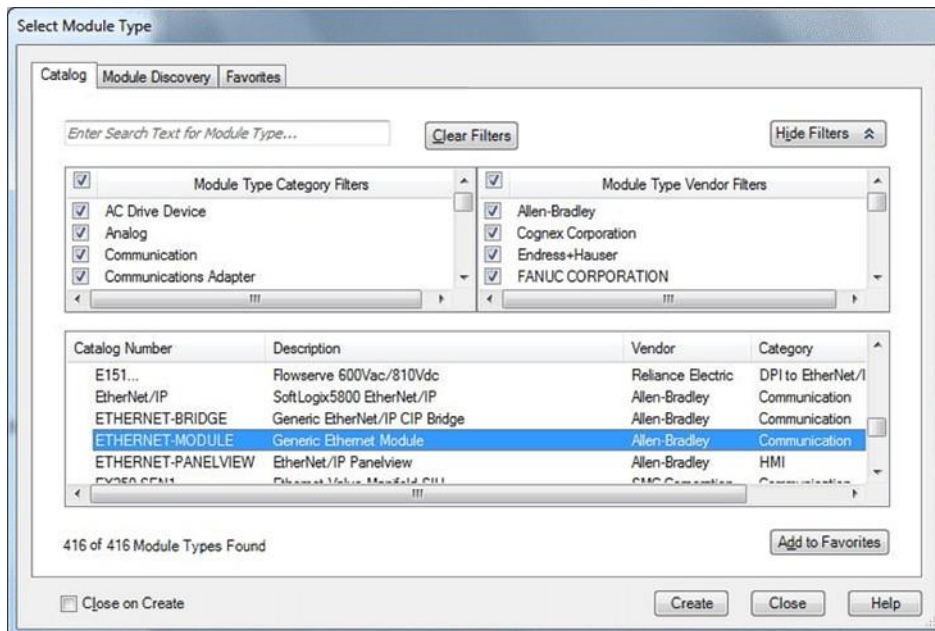
Configure the cyclic data transfer (Implicit Messaging) in »RSLogix™ 5000« (from version 20):

1. Network configuration of the inverter.

1. Go to the navigation tree ("Controller Organizer") under "I/O Configuration → Ethernet" and execute the context menu command "New Module" with a right-click.



2. Select the "ETHERNET MODULE Generic Ethernet Module" module type in the appearing dialog box.



3. Click "Create".
The "New Module" dialog box is opened.
4. Fill in input fields.

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.

Information on the assembly objects: [► Supported CIP objects](#)

Further entries:

- a) The name to be entered should refer to the process or the device.
- b) When entering the IP address, make sure that the inverter (adapter) is in the same network as the PLC (scanner). The subnetwork corresponds to the first three bytes of the IP address.

See also: [► Basic setting and options](#)

- c) Select "Data-INT" for the "Comm Format" since the data in the assembly objects 73 and 23 are given in 16-bit-integer words.
- d) The required size "0" is entered for the configuration assembly 130.
- e) Size "3" is entered for the assembly input object 73.
- f) Size "3" is entered for the assembly output object 23.

The inverter (adapter) must be in the same subnetwork as the PLC (scanner). The subnetwork corresponds to the first three 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.

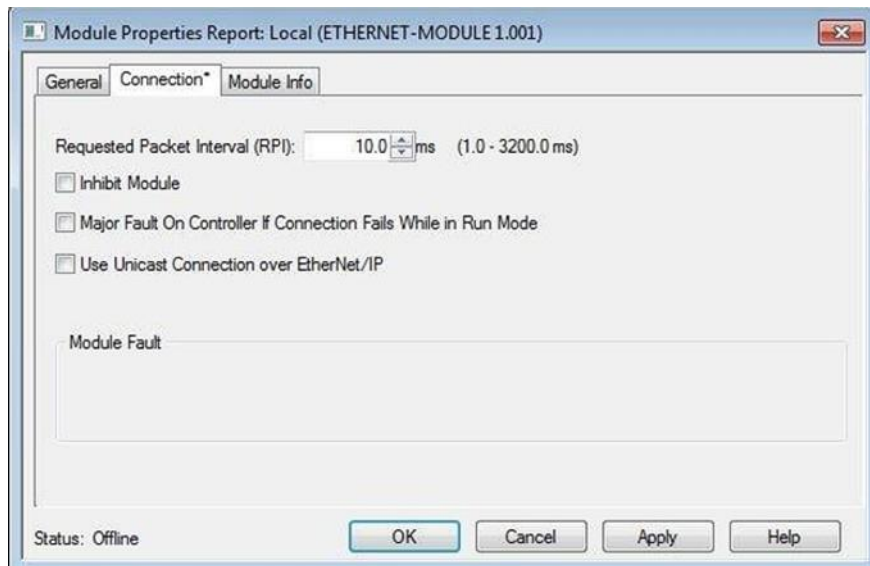
If the network control is active (0x400B:001 (P592.01)/bit 5 = 1 and 0x2631:037 (P400.37) = 114), all bits of the AC drive control word (0x400B:001 (P592.01)) are processed.

If the network control is not active (0x400B:001 (P592.01)/bit 5 = 0 or 0x2631:037 (P400.37) = 0), the control bits 0, 1, 12, 13, 14, 15 are *not* processed. Their states are ignored and the drive is in local control.

5. Click "OK".

The "Module Properties Report: ..." dialog box is opened.

6. Set the RPI rate.



The example shows the default setting of the RPI rate with "10.0" ms. This means that the inverter is queried every 10 milliseconds by the scanner. For the most inverter applications, it is not required to query the inverter more frequently.

The minimum value for inverters of the i series is 4.0 ms.

7. Activate/deactivate "Use Unicast Connection over EtherNet/IP".

The inverter supports "Unicast Connection over EtherNet/IP". The activation of this function causes a faster overall network power. The use of this function, however, can make the error correction for managed switches more complicated.

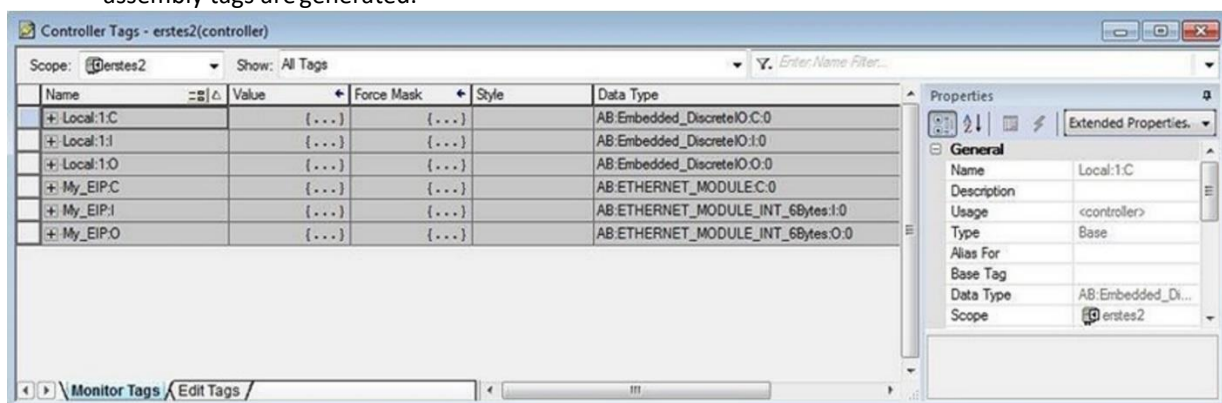
8. Make optional settings.

- a) Activating "Inhibit Module" inhibits the inverter.
- b) Activating "Major Fault On Controller If Connection Fails While in Run Mode" switches the inverter to "error" if the EtherNet/IP connection to the inverter gets lost during operation.

9. Click "OK".

The network configuration of the inverter is now completed.

In the navigation tree ("Controller Organizer") under "Controller → ControllerTags", assembly tags are generated.



In the sample configuration with the "My_EIP" inverter, these three assembly tags are generated:

"My_EIP:C" for the configuration assembly

"My_EIP:I" for the input assembly

"My_EIP:O" for the output assembly

By clicking [+] in front of the assembly names, the display of the assemblies is extended.

Controller Tags - erstes2(controller)

Scope: erstes2 Show: All Tags Enter Name Filter...

Name	Value	Force Mask	Style	Data Type
+ Local:1.C	{...}	{...}		AB.Embedded_DiscreteIO.C.0
+ Local:1.I	{...}	{...}		AB.Embedded_DiscreteIO:1:0
+ Local:1.O	{...}	{...}		AB.Embedded_DiscreteIO.O.0
+ My_EIP.C	{...}	{...}		AB.ETHERNET_MODULE.C.C.0
+ My_EIP.I	{...}	{...}		AB.ETHERNET_MODULE.INT_6Bytes:1:0
- My_EIP.O	{...}	{...}		AB.ETHERNET_MODULE.INT_6Bytes:0:0
- My_EIPO.Data	{...}	{...}	Decimal	INT[3]
+ My_EIPO.Data[0]	0		Decimal	INT
+ My_EIPO.Data[1]	0		Decimal	INT
+ My_EIPO.Data[2]	0		Decimal	INT

Properties

Extended Properties...

General

Name: My_EIP.C

Description:

Usage: <controller>

Type: Base

Alias For:

Base Tag:

Data Type: AB.ETHERNET_...

Scope: erstes2

External Access: Read/Write

Style:

Constant: No

Monitor Tags Edit Tags

Scope: @Gentex2 Show: All Tags

Name	Value	Force Mask	Style	Data Type	Description	Constant
+ Local 1.C	[...]	[...]		AB Embedded_DiscreteIO.C.0		
+ Local 1.I	[...]	[...]		AB Embedded_DiscreteIO.I.0		
+ Local 1.Q	[...]	[...]				
+ My_EPC	[...]	[...]				
+ My_EPI	[...]	[...]				
+ My_EPO	[...]	[...]				

New Tag

Name: Run_Rew Create

Description:

Usage: controllers

Type: Alias Connection

Alias For: My_EPO Data[3]

Data Type: W Enter Name Filter...

Show: All Tags

Parameter Connection	Name	Data Type	Description
9	@ Local 1.C	AB Embedded_DiscreteIO.C.0	
9	@ My_EPC	AB ETHERNET_WOODUOLE.C.0	
9	@ My_EPI	AB ETHERNET_WOODUOLE.INT_6bytes.I.0	
9	@ My_EPO	AB ETHERNET_WOODUOLE.INT_6bytes.Q.0	
9	@ My_EPO Data	INT[3]	
9	My_EPO Data[3]	INT	
9	0 1 2 3 4 5 6 7	INT	
9	8 9	Used: N	
9	10 11 12 13 14 15	INT Used: N	

Style:

☐ Constant

☐ Sequencing ☒ Show comments ☐ Show program tags

☐ Open Config

☐ Open Param

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3.11.6.1 Customised configurations

In addition to the defined AC Drive Profile, the inverter supports customer specific configurations.

Conditions

The inverter must be registered with an EDS device description file in the programming software for a customer specific configuration (e. g. »RSLogix™ 5000« by Rockwell Automation® Corporation).

- [Download of EDS files](#)

Afterwards, I/O data can be freely assigned in the assembly objects 110 (Custom Output) and 111 (Custom Input).

See "0x04: Assembly Object": [► Supported CIP objects](#)

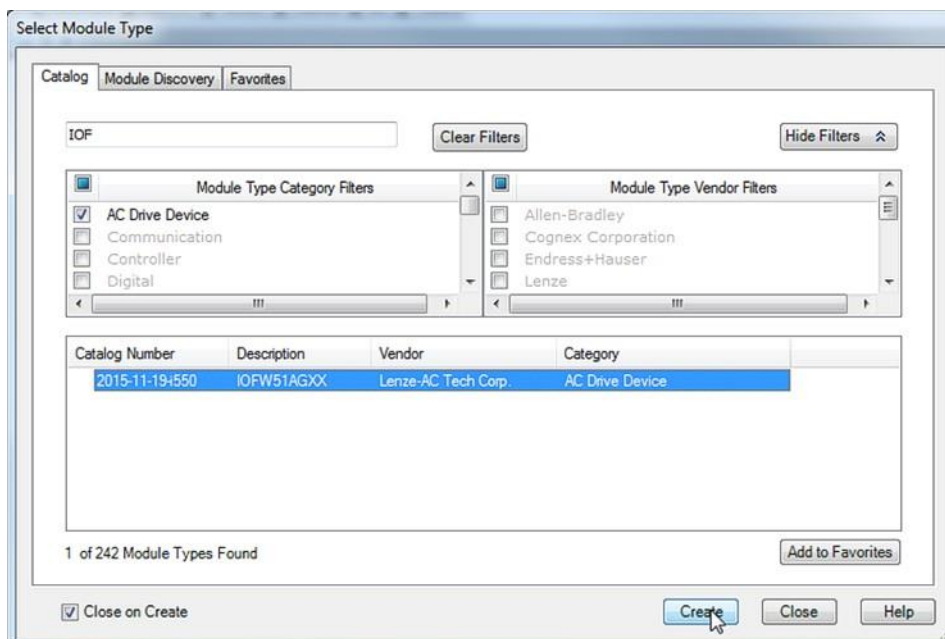
The configuration defines the parameters to be transmitted by means of the assembly objects 110 and 111. Two methods are available:

- Supporting scanners of class 1 can configure the data assignment in the inverter with the following procedure:
See [I/O configuration with »RSLogix 5000®« \(version 20 or higher\)](#).
- Alternatively, other masters can be used that do not support this data mapping for the user-defined assembly objects 110 and 111. The data assignment, however, must be configured in the inverter itself.
- Internal mapping of the process output data (110): [0x24E0:001 ... 0x24E0:016](#)
- Internal mapping of the process input data (111): [0x24E1:001 ... 0x24E1:016](#)

3.11.6.2 I/O configuration with »RSLogix 5000®« (version 20 or higher)

Execute a customer specific configuration in »RSLogix™ 5000« (from version 20):

1. Open the dialog "Select Module Type".



2. Go to the "Catalog" tab ...

- a) and select the "AC Drive Device" type category.
- b) select the "IOFW51AGXX" catalog.

3. Click "Create".

The "New Module" dialog box is opened.

The screenshot shows the 'New Module' dialog box with the 'General' tab selected. The dialog has a title bar with a close button. Below the title bar are tabs: 'General*', 'Connection', 'Module Info', 'Internet Protocol', 'Port Configuration', and 'Network'. The 'General' tab contains the following fields:

- Type: 2015-11-19:550 IOFW51AGXX
- Vendor: Lenze-AC Tech Corp.
- Parent: ScannerEIP
- Name: MyDevice
- Description: (empty text area)
- Ethernet Address:
 - ☒ Private Network: 192.168.1. 10
 - ☐ IP Address: . . .
 - ☐ Host Name:
- Module Definition:
 - Revision: 1.5
 - Electronic Keying: Compatible Module
 - Connections: Custom I/O Connection
- Change ... button

At the bottom, there is a 'Status: Creating' label and three buttons: 'OK', 'Cancel', and 'Help'.

4. Go to the "General" tab ...

- a) assign a name for the inverter.
- b) assign an *unambiguous* IP address.



DNS is not supported.

The host name only describes the device.

5. Click "Change".

6. Open the "Module Definition" dialog box.

7. 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).

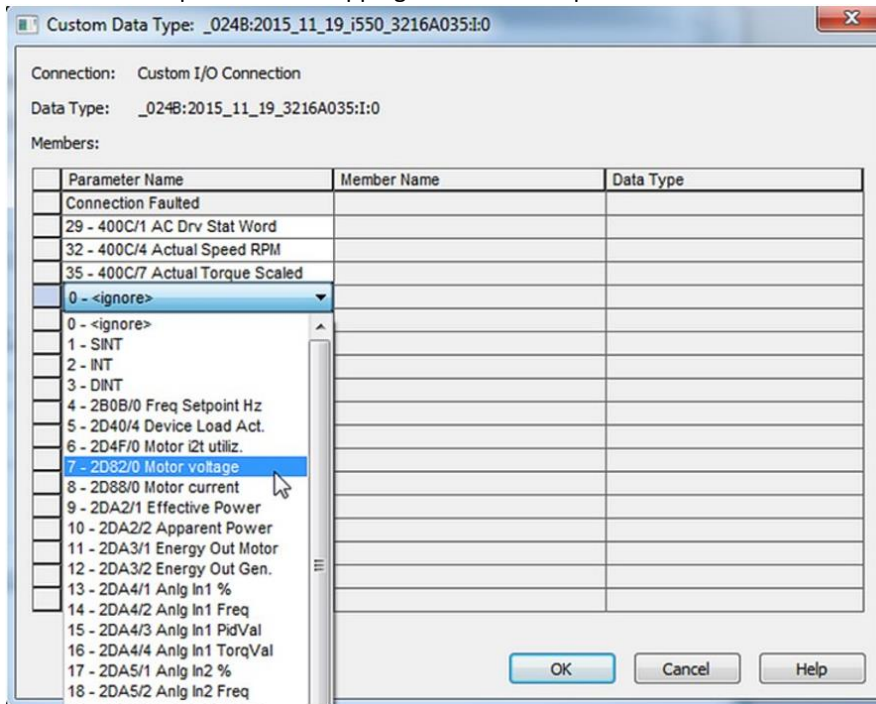
The real data length of each object that is mapped in the I/O data is determined by the inverter OBD object.

INT and SINT prevent an uneven data length.

DINT prevent an uneven number of data words.

8. Click "Change" in the line "Input" or "Output" to adapt the corresponding mapping individually.

This example shows a mapping selection for inputs:



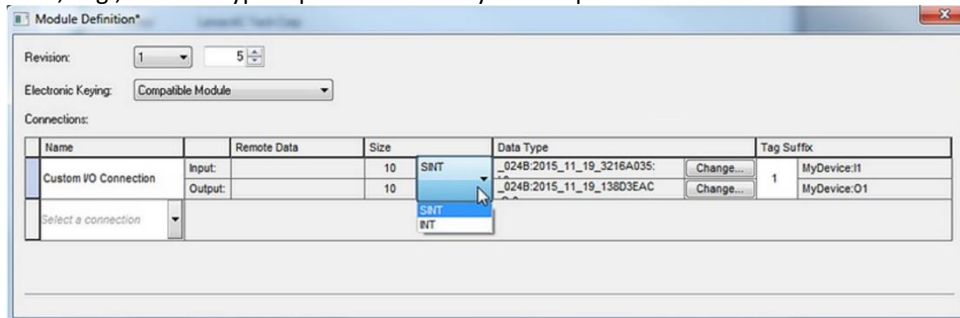
9. Group the process data according to their data length to prevent gaps. Example:

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.

Save the »RSLogix™« project and load the configuration into the PLC (scanner):

1. »RSLogix™« project must be saved.

Click "File" in the upper toolbar and execute the "Save" menu command.

If the project is saved for the first time, the "Save as" dialog box appears. Here, navigate to a folder, enter a filename, and click on "Save".

The configuration is saved in a file on your PC.

2. Load configuration into the scanner.

a) Click "Communications" in the upper toolbar and execute the "Download" menu command.

The "Download" dialog box is opened.

b) Click "Download".

The configuration is loaded into the scanner.

If the download has been completed successfully, »RSLogix™« changes to the online mode and the I/O-OK field in the upper left area of the screen is green.

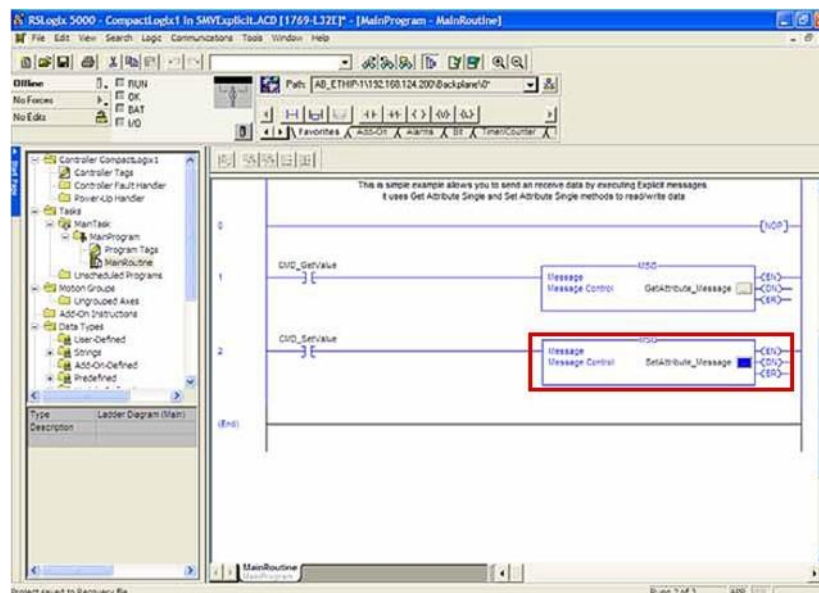
3.11.7 Parameter data transfer

- 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!

Message Configuration - Motor_Current_MSG

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Get Attribute Single

Service Code: e (Hex) Class: 6e (Hex) Instance: 54 Attribute: 1 (Hex)

Source Element: Source Length: 0 (Bytes) Destination Element: Motor_Current

Enable Enable Waiting Start Done Done Length: 0

Error Code: Error Path: Error Text: Extended Error Code: Timed Out

OK Cancel Apply Help

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

Message Configuration - Accel_Time_MSG

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Set Attribute Single

Service Code: 10 (Hex) Class: 6e (Hex) Instance: 12 Attribute: 1 (Hex)

Source Element: Accel_Time Source Length: 4 (Bytes) Destination Element:

Enable Enable Waiting Start Done Done Length: 0

Error Code: Error Path: Error Text: Extended Error Code: Timed Out

OK Cancel Apply Help

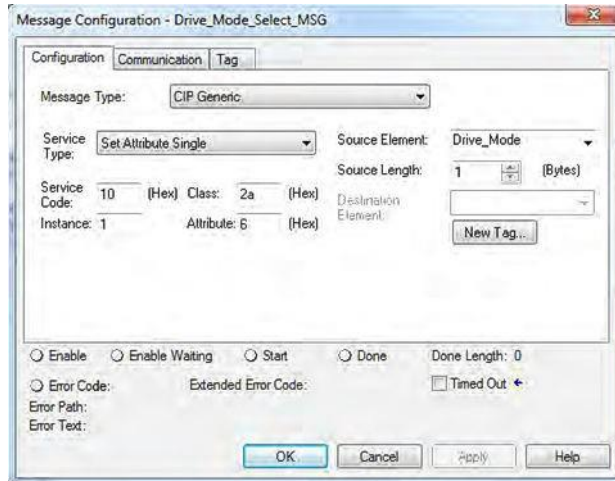
Write variables "TorqueScale" and "Drive_Mode"

The variables "TorqueScale" and "Drive_Mode" are AC drive profile objects

They are defined in the CIP library:

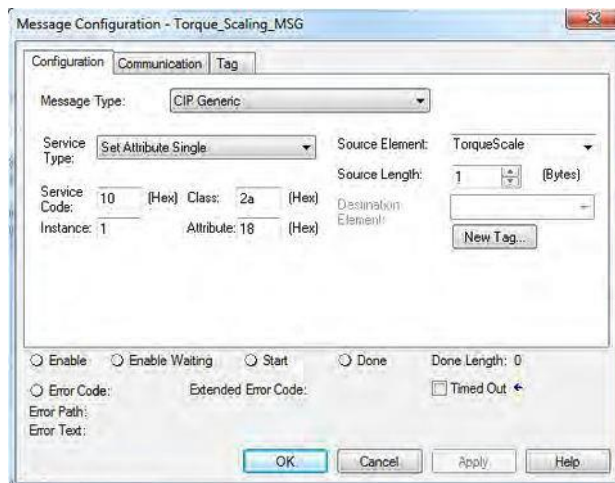
Variable	Class	Instance	Attribute	Data type	Size
Drive_Mode	2a	1	6	SINT	1 byte
TorqueScale	2a	1	18	SINT	1 byte

- 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 (P510.10): Timeout
- 0x2859:007 (P515.07): Timeout communication

3.11.8 Monitoring

The parameters for setting network monitoring functions are described below.

Parameter






Address	Name / setting range / [default setting]	Information
0x23A1:010 (P510.10)	EtherNet/IP settings: Timeout (EtherN/IP sett.: 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 (P515.07) is triggered in the inverter.
0x2859:001 (P515.01)	EtherNet/IP monitoring: Watchdog elapsed (EtherN/IP monit.: WD elapsed)	Selection of the response to a permanent interruption of the communication to the Scanner, e. g. by cable break or failure of the Scanner. Associated error code: • 33168 0x8190 - Network: watchdog timeout
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:003 (P515.03)	EtherNet/IP monitoring: Invalid configuration (EtherN/IP monit.: Invalid config)	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
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:004 (P515.04)	EtherNet/IP monitoring: Initialisation error (EtherN/IP monit.: Init. error)	Selection of the response triggered by the occurrence of an error during the initialisation of the network component. Associated error code: • 33170 0x8192 - Network: initialisation error
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:005 (P515.05)	EtherNet/IP monitoring: Invalid process data (EtherN/IP monit.: Inval. proc.data)	Selection of the response triggered by the reception of invalid process data. Associated error code: • 33171 0x8193 - Network: invalid cyclic process data
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:006 (P515.06)	EtherNet/IP monitoring: Timeout explicit message (EtherN/IP monit.: Timeout ExplMsg)	Selection of the response to time-outs during the transfer of Explicit Messages. Associated error code: • 33042 0x8112 - Network: timeout explicit message
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:007 (P515.07)	EtherNet/IP monitoring: Timeout communication (EtherN/IP monit.: Timeout Comm.)	Selection of the response to the time-out during the CIP communication. The monitoring time for the CIP communication is defined in 0x23A1:010 (P510.10) . Associated error code: • 33044 0x8114 - Network: overall communication timeout
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	






3.11.9 Diagnostics

3.11.9.1 LED status display

Information on the CIP status can be obtained quickly via the "MS" and "NS" LED displays on the front of the inverter. In addition, the LEDs at the RJ45 sockets indicate the connection status.


The meaning of the "NS" and "MS" LEDs can be obtained from the following two tables.

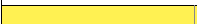
LED "NS" (green/red)	CIP network status	Status/meaning
off	No IP address	The network option is not supplied with voltage or has not received an IP address yet.
 On (green)	Connected	The network option works correctly and has established a connection to the scanner.
 Blinking green	No connections	The network option <ul style="list-style-type: none"> • 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.

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.

Status displays at the RJ45 sockets

The LEDs at the RJ45 sockets indicate the connection status to the network:

LED "Link" (green)	Status/meaning
off	No connection to the network.
 on	A physical connection to the network is available.

LED "Activity" (yellow)	Status/meaning
off	No data transfer.
 on or flickers	Data is exchanged via the network.

3.11.9.2 Information on the network

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x23A2:001 (P511.01)	Active EtherNet/IP settings: IP address (EtherN/IP diag.: IP address) • Read only	Display of the active 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
0x23A2:002 (P511.02)	Active EtherNet/IP settings: Subnet (EtherN/IP diag.: Subnet) • Read only	Display of the active subnet mask. The default setting 16777215 corresponds to the subnet mask 255.255.255.0. • 16777215 = 0xFFFFF → 0xFF.0xFF.0xFF.0x00 = 255.255.255.0

Address	Name / setting range / [default setting]	Information
0x23A2:003 (P511.03)	Active EtherNet/IP settings: Gateway (EtherN/IP diag.: 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 =
0x23A2:005 (P511.05)	Active EtherNet/IP settings: MAC address (EtherN/IP diag.: MAC address) • Read only	Display of the active MAC address.
→(P511.06)	Active EtherNet/IP settings: Multicast address (EtherN/IP diag.: Mcast address) • Read only	Display of the active Multicast IP address. The default setting 3221373167 corresponds to the Multicast IP address 239.64.2.192. • 3221373167 = 0xC00240EF → 0xEF.0x40.0x02.0xC0 = 239.64.2.192
0x23A5:001 (P519.01)	Active port settings: Port 1 (X266) (Port diagnostics: Port 1 (X266)) • Read only	Display of the active configuration for Ethernet port 1.
	0 Not connected	
	1 10 Mbps/Half Duplex	
	2 10 Mbps/Full Duplex	
	3 100 Mbps/Half Duplex	
	4 100 Mbps/Full Duplex	
0x23A5:002 (P519.02)	Active port settings: Port 2 (X267) (Port diagnostics: Port 2 (X267)) • Read only	Display of the active configuration for Ethernet port 2.
	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	
0x23A6 (P513.00)	Quality of service (QualityOfService) • Read only	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	
0x23A7 (P514.00)	Address conflict detection (AddrConflictDetec)	Activate address conflict detection (ACD) (enable). • If this value is changed, the device must be reset ("Power off/on" or "Type 0 Reset").
	0 Disabled	
	1 Enabled	
0x23A8 (P516.00)	CIP module status (CIP module stat.) • Read only	Display of the active CIP module status.
	0 Nonexistent	Display of the active CIP module status.
	1 Device self testing	
	2 Standby	
	3 Operational	
	4 Major recoverable fault	
	5 Major unrecoverable fault	

Address	Name / setting range / [default setting]	Information
0x23A9 (P517.00)	EtherNet/IP status (EtherN/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	

3.12 Modbus RTU



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.

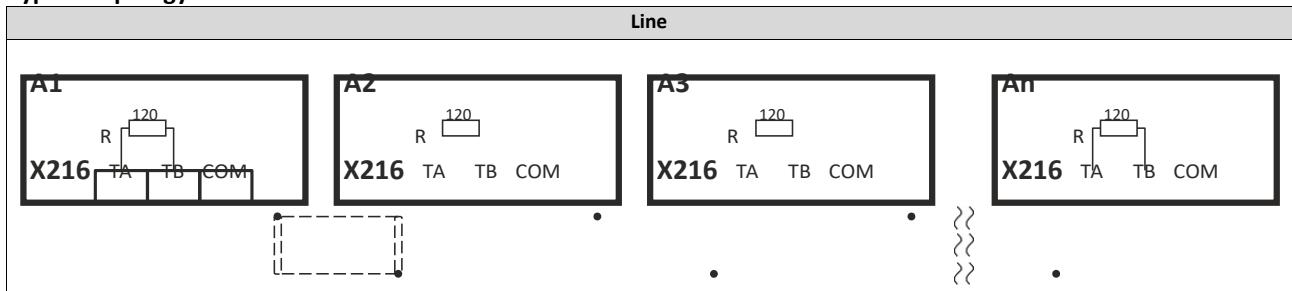
Preconditions

- The control unit (CU) of the inverter is provided with Modbus.

Details

- The process of data transmission distinguishes between three different operating modes: Modbus ASCII, Modbus RTU and Modbus TCP. This chapter describes the Modbus RTU operating mode ("Remote Terminal Unit").
- The Modbus protocol is based on a master/slave architecture where the inverter always works as slave.
- The Modbus network only permits one master sending commands and requests. The master is also the sole instance to be allowed to initiate Modbus communication. No direct communication takes place between the slaves.
- The physical interface corresponds to TIA/EIA-485-A which is very common and suitable for the industrial environment. This interface enables baud rates from 2400 to 115200 kbps.
- The inverter supports Modbus function codes 3, 6, 16 (0x10) and 23 (0x17).

Typical topology



3.12.1 Commissioning

In the following, the steps required for controlling the inverter via Modbus are described.

Parameterization required

1. Activate network control: **0x2631:037 (P400.37)** = "TRUE [1]"
2. Set network as standard setpoint source: **0x2860:001 (P201.01)** = "Network [5]"
3. Set Modbus node address.
 - Each network node must be provided with a unique node address.
 - See: [► Basic setting and options](#)
4. Set Modbus baud rate.
 - Default setting: Automatic detection.
 - If the automatic baud rate detection function is activated, the first 5 to 10 messages are lost after switch-on.
 - See: [► Basic setting and options](#)
5. Set Modbus data format.
 - Default setting: Automatic detection.
 - If the automatic data format detection function is activated, the first 5 to 10 messages are lost after switch-on.
 - See: [► Basic setting and options](#)
6. Save parameter settings: **0x2022:003 (P700.03)** = "on / start [1]".
7. 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](#)

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 (P592.01)** (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

Example of an inverter with the node address 1:

Request frame by the master					
Slave address	Function code	Data			
		Register address		AC Drive control word	
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					
Slave address	Function code	Data			
		Register address		AC Drive control word	
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

Example of an inverter with the node address 1:

Request frame by the master					
Slave address	Function code	Data			
		Register address		Network setpoint frequency (0.01)	
0x01	0x06	0x08	0x35	0x04	0xD2

Response message from the inverter					
Slave address	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

The function code 3 is used to read a single register or several interrelated register blocks, see:

► Function codes

Example of an inverter with the node address 1:

Request frame by the master					
Slave address	Function code	Data			
		Register address		Number of words	
0x01	0x03	0x07	0xD1	0x00	0x01

Response message from the inverter					
Slave address	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) **0x2320 (P508.00) Set = "Restart with current values [1]"**.

Parameter

Address	Name / setting range / [default setting]	Information
0x2320 (P508.00)	Modbus communication (Modbus comm.)	1 = restart communication in order that changed settings of the interface configuration become effective.
	0 No action/no error	
	1 Restart with current values	

3.12.2 Basic setting and options

Node address setting

Each network node must be provided with a unique node address.

- The node address of the inverter can be optionally set in [0x2321:001 \(P510.01\)](#) or using the DIP switches on the device labelled with "1" ... "128".
- The setting that is active when the inverter is switched on is the effective setting.
- The labelling of the DIP switches corresponds to the values of the individual DIP switches for determining the node address (see the following example).
- The node address 0 is reserved for messages to all nodes ("Broadcast").
- The active node address is shown in [0x2322:001 \(P511.01\)](#).

Example of how the node address is set via the DIP switches

DIP switch	128	64	32	16	8	4	2	1
Setting	OFF	OFF	OFF	ON	OFF	ON	ON	ON
Value	0	0	0	16	0	4	2	1
Node address	= sum of all values = 16 + 4 + 2 + 1 = 23							

Parameter

Address	Name / setting range / [default setting]	Information
0x2321:001 (P510.01)	Modbus settings: Node ID (Modbus sett.: Node ID) 1 ... [1] ... 247	Optionally setting of the node address (instead of setting via DIP switches 1 ... 128). <ul style="list-style-type: none"> • The node address set here only becomes effective if DIP switches 1 ... 128 have been set to OFF before mains switching. • A change in the node address only becomes effective after a restart of Modbus communication.

3.12.2.1 Baud rate setting

All network nodes must be set to the same baud rate.

- If the DIP switch labelled with "b" is in the OFF position at switch-on, the automatic baud rate detection function is active. If it is in the ON position, the setting in [0x2321:002 \(P510.02\)](#) applies instead.
- If the automatic baud rate detection function is activated, the first 5 ... 10 messages are lost after switch-on.
- The active baud rate is displayed in [0x2322:002 \(P511.02\)](#).

Parameter

Address	Name / setting range / [default setting]	Information
0x2321:002 (P510.02)	Modbus settings: Baud rate (Modbus sett.: Baud rate)	Optionally setting of the baud rate (instead of setting via DIP switch b). <ul style="list-style-type: none"> • The baud rate set here is only effective if DIP switch b was set to ON before mains switching. Otherwise automatic baud rate detection is active. • A change in the baud rate only becomes effective after a restart of Modbus communication. • If the automatic baud rate detection function is activated, the first 5 ... 10 messages are lost after switch-on.
	0 Automatic	
	1 2400 bps	
	2 4800 bps	
	3 9600 bps	
	4 19200 bps	
	5 38400 bps	
	6 57600 bps	
	7 115200 bps	

3.12.2.2 Data format setting

All network nodes must be set to the same data format.

- If the DIP switch labelled with "a" is in the OFF position at switch-on, the automatic data format detection function is active. If it is in the ON position, the setting in [0x2321:003 \(P510.03\)](#) applies instead.
- If the automatic data format detection function is activated, the first 5 ... 10 messages are lost after switch-on.
- The active data format is displayed in [0x2322:003 \(P511.03\)](#).

Parameter

Address	Name / setting range / [default setting]	Information
0x2321:003 (P510.03)	Modbus settings: Data format (Modbus sett.: Data format)	Definition of the parity and stop bits.
	0 Automatic	Automatic data format detection. <ul style="list-style-type: none">• With this setting, the first 5 ... 10 messages are lost after switch-on.
	1 8, E, 1	8 data bits, even parity, 1 stop bit
	2 8, O, 1	8 data bits, odd parity, 1 stop bit
	3 8, N, 2	8 data bits, no parity bit, 2 stop bits
	4 8, N, 1	8 data bits, no parity bit, 1 stop bit

3.12.2.3 Minimum response time setting

Some Modbus masters have issues turning around their transceiver at higher baud rates. To resolve integration issues the user may use Modbus: Minimum Response Time (0x2321:004) to set a minimum time delay to be observed between the receipt of a valid Modbus message and the drive's response. Time is entered in milliseconds [0x2321:004 \(P510.04\)](#).

Parameter

Address	Name / setting range / [default setting]	Information
0x2321:004 (P510.04)	Modbus settings: Minimum response time (Modbus sett.: Min. resp. time) 0 ... [0] ... 1000 ms	Minimum time delay between the reception of a valid message and the response of the drive.

3.12.3 Data transfer

The mode of access to inverter data (parameters) is controlled via function codes.

3.12.3.1 Function codes

The inverter supports the following function codes:

Function code	Function name	Description
3	0x03	Read Holding Registers Read one or more 16-bit data words.
6	0x06	Preset Single Register Write a 16-bit data word.
16	0x10	Preset Multiple Registers Write one or more 16-bit data words.
23	0x17	Read/Write 4X Registers Within a transaction <ul style="list-style-type: none">• write into a group of connected 4X holding registers.• read from a group of connected 4X holding registers.

Addressing

- The function codes listed above exclusively refer to 4X registers in Modbus addressing.
- All data in the inverter can only be accessed via 4X registers, i.e. via register addresses from 40001.
- 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.
- Sinus S 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.

Frame structure

Communication is established on the basis of the central medium access method.

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 a valid Modbus frame). Error causes can be invalid CRC checksums, function codes that are not supported, or impermissible data access.

All Modbus frames have the following basic structure:

- A "frame" consists of a PDU (Protocol Data Unit) and an ADU (Application Data Unit).
- The PDU contains the function code and the data belonging to the function code.
- The ADU serves the purposes of addressing and error detection.
- The data are represented in Big Endian format (most significant byte first).

ADU (Application Data Unit)			
Slave address	Function code	Data	Checksum (CRC)
	PDU (Protocol Data Unit)		

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.

3.12.3.2 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.

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 (P592.01)	AC Drive control word
42102	0x400B:005 (P592.05)	Network setpoint frequency (0.01)
42103	0x400B:002 (P590.02)	NetWordIN2
42104	0x400B:003 (P590.03)	NetWordIN3
42105	0x400B:007 (P592.07)	PID setpoint
42106	0x6071	Set torque
42107	0x400B:001 (P590.01)	NetWordIN1
42108	0x400B:004 (P590.04)	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 (P593.01)	AC Drive status word
42002	0x400C:006 (P593.06)	Frequency (0.01)
42003	0x603F (P150.00)	Error code
42004	0x400C:005 (P593.05)	Drive status
42005	0x2D89 (P106.00)	Motor voltage
42006	0x2D88 (P104.00)	Motor current
42007	0x6078 (P103.00)	Actual current
42008	0x2DA2:002 (P108.02)	Apparent power (42008 = High Word, 42009 = Low Word)
42009		
42010	0x2D84:001 (P117.01)	Heatsink temperature
42011	0x2D87 (P105.00)	DC-bus voltage
42012	0x60FD (P118.00)	Digital input status (only bit 16 ... bit 31)
42013	0x6077 (P107.00)	Actual torque
42014 ... 42021	-	Reserved

Variable mapping

- Via [0x232B:001 ... 0x232B:024 \(P530.01 ... 24\)](#), 24 registers can be mapped to parameters of the inverter. Format:
0xiiii ss00
(iiii = index hexadecimal,
ss = subindex hexadecimal)
- The display of the internal Modbus register numbers in [0x232C:001 ... 0x232C:024 \(P531.01 ... 24\)](#) 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 [0x232D \(P532.00\)](#). 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
0x232B:001 ... 0x232B:024 (P530.01 ... 24)	Modbus parameter mapping: Parameter 1 ... Parameter 24 (Para. mapping: Parameter 1 ... Parameter 24) 0x00000000 ... [0x00000000] ... 0xFFFFFFFF00	Mapping entries for the variable mapped Modbus registers. • Format: 0xiiii ss00 (iiii = index, ss = subindex)
0x232C:001 ... 0x232C:024 (P531.01 ... 24)	Modbus register assignment: Register 1 ... Register 24 (Reg. assigned: Register 1 ... Register 24) • Read only	Display of the internal Modbus register number starting from which the parameter mapped in 0x232B:001 ... 0x232B:024 (P530.01 ... 24) 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.
0x232D (P532.00)	Modbus verification code (Verificationcode) • Read only	

3.12.4 Monitoring

The parameters for setting network monitoring functions are described below.

Parameter

Address	Name / setting range / [default setting]	Information
0x2858:001 (P515.01)	Modbus monitoring: Response to time-out (Modbus monit.: Resp. Time-out)	Selection of the response executed if no valid messages have been received via the Modbus for a longer time than the time-out period set in 0x2858:002 (P515.02) . Associated error code: • 33185 0x81A1 - Modbus: network time-out
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2858:002 (P515.02)	Modbus monitoring: Time-out time (Modbus monit.: Time-out time) 0.0 ... [2.0] ... 300.0 s	Time-out period for monitoring the message reception via Modbus.



3.12.5 Diagnostics

LED status display

Information on the Modbus status can be obtained quickly via the "COMM" and "ERR" LED displays on the front of the inverter.


The meaning can be seen from the tables below.

Inverter not active on the Modbus bus (yet)


LED "COMM"	LED "ERR"	Meaning
off	 on	Internal error
 Both LEDs are flickering alternately		Automatic detection of baud rate and data format active.

Inverter active on the Modbus

The green "COMM" LED indicates the communication status:

LED "COMM"	Communication status
off	No reception / no transmission
 on	Reception / transmission active

The red "ERR" LED indicates an error:

LED "ERR"	Fault
off	No fault
 blinking	Communication error

Information on the network

The following parameters serve to diagnose the communication activities between the inverter and the Modbus network.

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x2322:001 (P511.01)	Active Modbus settings: Active node ID (Modbus diag.: Active node ID) • Read only	Display of the active node address.
0x2322:002 (P511.02)	Active Modbus settings: Active baud rate (Modbus diag.: Active baud rate) • Read only	Display of the active baud rate.
	0 Automatic	Optionally setting of the baud rate (instead of setting via DIP switch b). • The baud rate set here is only effective if DIP switch b was set to ON before mains switching. Otherwise automatic baud rate detection is active. • A change in the baud rate only becomes effective after a restart of Modbus communication. • If the automatic baud rate detection function is activated, the first 5 ... 10 messages are lost after switch-on.
	1 2400 bps	
	2 4800 bps	
	3 9600 bps	
	4 19200 bps	
	5 38400 bps	
	6 57600 bps	
	7 115200 bps	
0x2322:003 (P511.03)	Active Modbus settings: Data format (Modbus diag.: Data format) • Read only	Display of the active data format.
	0 Automatic	Automatic data format detection. • With this setting, the first 5 ... 10 messages are lost after switch-on.
	1 8, E, 1	8 data bits, even parity, 1 stop bit
	2 8, O, 1	8 data bits, odd parity, 1 stop bit
	3 8, N, 2	8 data bits, no parity bit, 2 stop bits
	4 8, N, 1	8 data bits, no parity bit, 1 stop bit
0x2323 (P509.00)	Modbus switch position (Modbus switch) • Read only	Display of the DIP switch setting at the last mains power-on. • The value displayed corresponds to the sum of all DIP switch values (except for DIP switches for terminating resistor).
0x232A:001 (P580.01)	Modbus statistics: Messages received (Modbus statistic: Mess. 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".
0x232A:002 (P580.02)	Modbus statistics: Valid messages received (Modbus statistic: Val. mess. rec.) • Read only	Display of the number of valid messages received. • After the maximum value has been reached, the counter starts again "0".
0x232A:003 (P580.03)	Modbus statistics: Messages with exceptions (Modbus statistic: Mess. w. exc.) • 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".
0x232A:004 (P580.04)	Modbus statistics: Messages with errors (Modbus statistic: Mess. w. errors) • Read only	Display of the number of messages received with a faulty data integrity (parity, CRC). • After the maximum value has been reached, the counter starts again "0".
0x232A:005 (P580.05)	Modbus statistics: Messages sent (Modbus statistic: Messages sent) • Read only	Display of the total number of messages sent. • After the maximum value has been reached, the counter starts again "0".
0x232E:001 (P583.01)	Modbus diagnostics of last Rx data: Offset (Rx data diagn.: Rx data offset) 0 ... [0] ... 240	For purposes of diagnostics, the last message received (max. 16 bytes) is shown in 0x232E:002 (P583.02) ... 0x232E:017 (P583.17) . 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.
0x232E:002 (P583.02)	Modbus diagnostics of last Rx data: Data byte 0 (Rx data diagn.: Last RxD byte0) • Read only	
0x232E:003 (P583.03)	Modbus diagnostics of last Rx data: Data byte 1 (Rx data diagn.: Last RxD byte1) • Read only	
0x232E:004 (P583.04)	Modbus diagnostics of last Rx data: Data byte 2 (Rx data diagn.: Last RxD byte2) • Read only	
0x232E:005 (P583.05)	Modbus diagnostics of last Rx data: Data byte 3 (Rx data diagn.: Last RxD byte3) • Read only	

Address	Name / setting range / [default setting]	Information
0x232E:006 (P583.06)	Modbus diagnostics of last Rx data: Data byte 4 (Rx data diagn.: Last RxD byte4) • Read only	
0x232E:007 (P583.07)	Modbus diagnostics of last Rx data: Data byte 5 (Rx data diagn.: Letzt RxD-Byte5) • Read only	
0x232E:008 (P583.08)	Modbus diagnostics of last Rx data: Data byte 6 (Rx data diagn.: Last RxD byte6) • Read only	
0x232E:009 (P583.09)	Modbus diagnostics of last Rx data: Data byte 7 (Rx data diagn.: Last RxD byte7) • Read only	
0x232E:010 (P583.10)	Modbus diagnostics of last Rx data: Data byte 8 (Rx data diagn.: Last RxD byte8) • Read only	
0x232E:011 (P583.11)	Modbus diagnostics of last Rx data: Data byte 9 (Rx data diagn.: Last RxD byte9) • Read only	
0x232E:012 (P583.12)	Modbus diagnostics of last Rx data: Data byte 10 (Rx data diagn.: Last RxD byte10) • Read only	
0x232E:013 (P583.13)	Modbus diagnostics of last Rx data: Data byte 11 (Rx data diagn.: Last RxD byte11) • Read only	
0x232E:014 (P583.14)	Modbus diagnostics of last Rx data: Data byte 12 (Rx data diagn.: Last RxD byte12) • Read only	
0x232E:015 (P583.15)	Modbus diagnostics of last Rx data: Data byte 13 (Rx data diagn.: Last RxD byte13) • Read only	
0x232E:016 (P583.16)	Modbus diagnostics of last Rx data: Data byte 14 (Rx data diagn.: Last RxD byte14) • Read only	
0x232E:017 (P583.17)	Modbus diagnostics of last Rx data: Data byte 15 (Rx data diagn.: Last RxD byte15) • Read only	
0x232F:001 (P585.01)	Modbus diagnostics of last Tx data: Offset (Tx data diagn.: Tx data offset) 0 ... [0] ... 240	For purposes of diagnostics, the last message sent (max. 16 bytes) is shown in 0x232F:002 (P585.02) ... 0x232F:017 (P585.17) . 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.
0x232F:002 (P585.02)	Modbus diagnostics of last Tx data: Data byte 0 (Tx data diagn.: Last TxD byte0) • Read only	Display of the message sent last.
0x232F:003 (P585.03)	Modbus diagnostics of last Tx data: Data byte 1 (Tx data diagn.: Last TxD Byte1) • Read only	
0x232F:004 (P585.04)	Modbus diagnostics of last Tx data: Data byte 2 (Tx data diagn.: Last TxD byte2) • Read only	
0x232F:005 (P585.05)	Modbus diagnostics of last Tx data: Data byte 3 (Tx data diagn.: Last TxD byte3) • Read only	
0x232F:006 (P585.06)	Modbus diagnostics of last Tx data: Data byte 4 (Tx data diagn.: Last TxD byte4) • Read only	
0x232F:007 (P585.07)	Modbus diagnostics of last Tx data: Data byte 5 (Tx data diagn.: Last TxD byte5) • Read only	
0x232F:008 (P585.08)	Modbus diagnostics of last Tx data: Data byte 6 (Tx data diagn.: Last TxD byte6) • Read only	
0x232F:009 (P585.09)	Modbus diagnostics of last Tx data: Data byte 7 (Tx data diagn.: Last TxD byte7) • Read only	
0x232F:010 (P585.10)	Modbus diagnostics of last Tx data: Data byte 8 (Tx data diagn.: Last TxD byte8) • Read only	

Address	Name / setting range / [default setting]	Information
0x232F:011 (P585.11)	Modbus diagnostics of last Tx data: Data byte 9 (Tx data diagn.: Last TxD byte9) • Read only	
0x232F:012 (P585.12)	Modbus diagnostics of last Tx data: Data byte 10 (Tx data diagn.: Last TxD byte10) • Read only	
0x232F:013 (P585.13)	Modbus diagnostics of last Tx data: Data byte 11 (Tx data diagn.: Last TxD byte11) • Read only	
0x232F:014 (P585.14)	Modbus diagnostics of last Tx data: Data byte 12 (Tx data diagn.: Last TxD byte12) • Read only	
0x232F:015 (P585.15)	Modbus diagnostics of last Tx data: Data byte 13 (Tx data diagn.: Last TxD byte13) • Read only	
0x232F:016 (P585.16)	Modbus diagnostics of last Tx data: Data byte 14 (Tx data diagn.: Last TxD byte14) • Read only	
0x232F:017 (P585.17)	Modbus diagnostics of last Tx data: Data byte 15 (Tx data diagn.: Last TxD byte15) • Read only	

3.13 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.

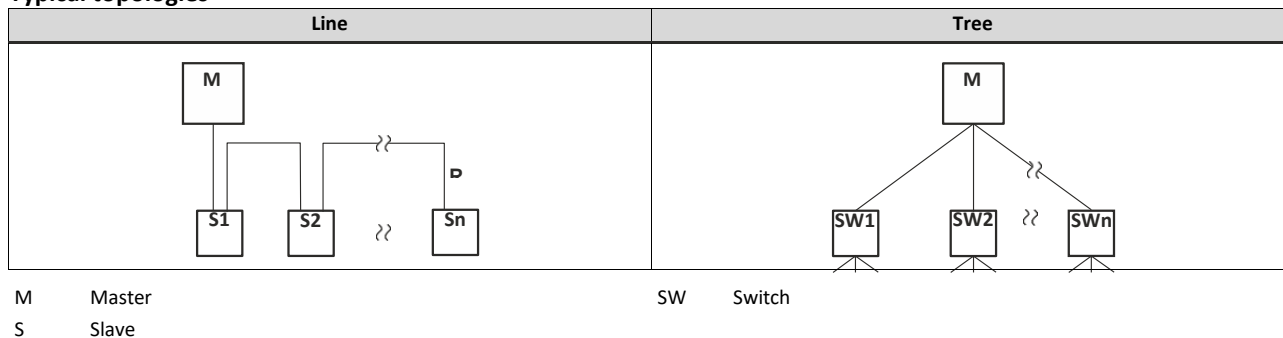
Preconditions

The control unit (CU) of the inverter is provided with Modbus TCP.

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



3.13.1 Commissioning

In the following, the steps required for controlling the inverter via Modbus are described.

Parameterization required

1. Activate network control: **0x2631:037 (P400.37) = "TRUE [1]"**
2. Set network as standard setpoint source: **0x2860:001 (P201.01) = "Network [5]"**
3. Implement the IP settings of the inverter (slave).
See: ▶ [IP settings](#)
4. Set Modbus baud rate.
 - Default setting: Automatic detection.
 - See: ▶ [Baud rate setting](#)
5. Save parameter settings: **0x2022:003 (P700.03) = "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](#)



An internal web server is supported. It can be addressed via the IP address defined in the [0x23A1:001 \(P510.01\)](#) parameter. Protect access to the web server, e.g. with a firewall, and follow your internal IT security guidelines.



A firmware download from the PLC to the inverter via the network (also via FTP) only takes place under the following conditions:

- **Required firmware version 05.01.x.x or higher**
- **Bootloader version 00.00.00.18 or higher**

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 \(P592.01\)](#) (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](#)

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](#)

The function code 3 is used to read a single register or several interrelated register blocks, see:

► [Function codes](#)

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 (P508.00) Set = "Restart with current values [1]".**

Parameter

Address	Name / setting range / [default setting]	Information
0x23B0 (P508.00)	Modbus TCP communication (MBTCP comm.)	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	

3.13.2 Basic setting and options

3.13.2.1 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.



An internal web server is supported. It can be addressed via the IP address defined in the parameter. Protect access to the web server, e.g. with a firewall, and follow your internal IT security guidelines.

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.

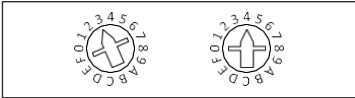
6. Enter the IP address, the subnet mask and, if required, the gateway address under "Use the following addresses".

7. Click "OK".

The IP basic settings are now completed.

Set IP address

The two rotary encoder switches at the front of the device serve to set the IP address in terms of hardware.

Setting	Addressing
0x00	IP address via the parameter 0x23B1:001 (P510.01) .
0x01 ... 0xFF	<p>Setting of the 4th byte of the IP address via the rotary encoder switch. 192.168.124.[setting] Example: Setting for the value 52 $(3 \times 16) + (4 \times 1) = 52$</p> <div style="text-align: center;">  </div>

The value set via the rotary encoder switches is used when the mains is switched on or after a network restart with [0x23B0 \(P508.00\)](#) = 1. A changed value during operation will only become valid after the network has been restarted.

- [0x23B3 \(P509.00\)](#) shows the switch setting at the last mains connection.
- [0x23B2:001 \(P511.01\)](#) shows the active IP address.

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 \(P510.06\)](#): 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 (P510.01)	Modbus -TCP/IP settings: IP address (MBTCP 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. • $276605120 = 0x107CA8C0 \rightarrow 0xC0.0xA8.0x7C.0x10 =$
0x23B1:002 (P510.02)	Modbus -TCP/IP settings: Subnet (MBTCP 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. • $16777215 = 0xFFFF \rightarrow 0xFF.0xFF.0xFF.0x00 = 255.255.255.0$
0x23B1:003 (P510.03)	Modbus -TCP/IP settings: Gateway (MBTCP 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. • $276344004 = 0x1078ACC4 \rightarrow 0xC4.0xAC.0x78.0x10 =$
0x23B1:005 (P510.05)	Modbus -TCP/IP settings: IP configuration (MBTCP 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 master via BOOTP.
0x23B1:006 (P510.06)	Modbus -TCP/IP settings: Time-to-live value (TTL) (MBTCP settings: TTL value) 1 ... [32] ... 255	Setting of the TTL value for the validity of data packages in the network.
	0 ... [502] ... 65535	Set port number for a second port.

13.13.2.2 Baud rate setting

- Set the baud rate for port 1 in [0x23B4:001 \(P512.01\)](#) and for port 2 in [0x23B4:002 \(P512.02\)](#).
- The automatic detection of the baud rate is preset for the ports.
- The active baud rate is displayed for port 1 in [0x23B5:001 \(P513.01\)](#) and for port 2 in [0x23B5:002 \(P513.02\)](#).

Parameter

Address	Name / setting range / [default setting]	Information
0x23B4:001 (P512.01)	Port settings: Port 1 (Port settings: Port 1)	Set baud rate for the 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 (P512.02)	Port settings: Port 2 (Port settings: Port 2)	Set baud rate for the 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	

3.13.3 Data transfer

The mode of access to inverter data (parameters) is controlled via function codes.

3.13.3.1 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: <ul style="list-style-type: none">• 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](#)
 - 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.
 - Sinus S 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	
Read 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	

3.13.3.2 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 (P530.01 ... 24) serves to map these 24 registers to parameters of the inverter.
40104	0103	
...	...	
40149	0148	
42001	2000	Predefined Modbus status registers For details see the following section "Predefined Modbus status registers".
...	...	
42021	2020	
42101	2100	Predefined Modbus control registers For details see the following section "Predefined Modbus control registers".
...	...	
42121	2120	

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 (P592.01)	AC Drive control word
42102	0x400B:005 (P592.05)	Network setpoint frequency (0.01)
42103	0x4008:002 (P590.02)	NetWordIN2
42104	0x4008:003 (P590.03)	NetWordIN3
42105	0x400B:007 (P592.07)	PID setpoint
42106	0x6071	Set torque
42107	0x4008:001 (P590.01)	NetWordIN1
42108	0x4008:004 (P590.04)	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 (P593.01)	AC Drive status word
42002	0x400C:006 (P593.06)	Frequency (0.01)
42003	0x603F (P150.00)	Error code
42004	0x400C:005 (P593.05)	Drive status
42005	0x2D89 (P106.00)	Motor voltage
42006	0x2D88 (P104.00)	Motor current
42007	0x6078 (P103.00)	Actual current
42008	0x2DA2:002 (P108.02)	Apparent power (42008 = High Word, 42009 = Low Word)
42009		
42010	0x2D84:001 (P117.01)	Heatsink temperature
42011	0x2D87 (P105.00)	DC-bus voltage
42012	0x60FD (P118.00)	Digital input status (only bit 16 ... bit 31)
42013	0x6077 (P107.00)	Actual torque
42014 ... 42021	-	Reserved

Variable mapping

- Via [0x23BB:001 ... 0x23BB:024 \(P530.01 ... 24\)](#), 24 registers can be mapped to parameters of the inverter. Format:
0xiiii00
(iiii = index,
ss = subindex)
- The display of the internal Modbus register numbers in [0x23BC:001 ... 0x23BC:024 \(P531.01 ... 24\)](#) 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 \(P532.00\)](#). 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 (P530.01 ... 24)	Modbus TCP/IP parameter mapping: Parameter 1 ... Parameter 24 (MBTCP param.mapp: Parameter 1 ... Parameter 24) 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entries for the variable mapped Modbus registers. • Format: 0xiiii00 (iiii = index, ss = subindex)
0x23BC:001 ... 0x23BC:024 (P531.01 ... 24)	Register assignment: Register 1 ... Register 24 (Register assignm: Register 1 ... Register 24) • Read only	Display of the internal Modbus register number starting from which the parameter mapped in 0x23BB:001 ... 0x23BB:024 (P530.01 ... 24) 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 (P532.00)	Verification code (Verificat. code) • Read only	

3.13.4 Monitoring

The response to the missing Modbus messages, configuration errors and initialisation errors can be configured via the following parameters.

The parameters for setting network monitoring functions are described below.

Parameter

Address	Name / setting range / [default setting]	Information
0x23B1:010 (P510.10)	Modbus -TCP/IP settings: Ethernet time-out (MBTCP settings: Ethernet timeout) 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 (P515.07) is triggered in the inverter.
0x23B6:001 (P514.01)	Time-out monitoring: Time-out time (MBTCP t-out mon: Time-out time) 0.0 ... [2.0] ... 300.0 s	Monitoring is active if the first valid write command arrives at the Modbus master. 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 master.
0x23B6:002 (P514.02)	Time-out monitoring: Keep alive time-out time (MBTCP t-out mon: Keep al t-out) 0.0 ... [2.0] ... 300.0 s	Monitoring is active after a valid value is written into the keep alive register 0x23B6:005 (P514.05) 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 (P514.05)	Time-out monitoring: Keep alive register (MBTCP t-out mon: Keep al 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: <ul style="list-style-type: none"> With a value of 1 ... 65535 and an interval that is shorter than the time set in 0x23B6:002 (P514.02).
0x2859:003 (P515.03)	Modbus TCP/IP monitoring: Configuration error (MBTCP monitoring: Config error)	
	0	No response
	1	Warning
	2	Trouble
	3	Fault
		Selection of the response triggered by the reception of invalid configuration data. Associated error code: <ul style="list-style-type: none"> 33414 0x8286 - Network: PDO mapping error ► Error types
0x2859:004 (P515.04)	Modbus TCP/IP monitoring: Initialisation error (MBTCP monitoring: Init error)	
	0	No response
	1	Warning
	2	Trouble
	3	Fault
		Selection of the response triggered by the occurrence of an error during the initialisation of the network component. Associated error code: <ul style="list-style-type: none"> 33170 0x8192 - Network: initialisation error ► Error types
0x2859:007 (P515.07)	Modbus TCP/IP monitoring: Fault reaction by time-out Network (MBTCP monitoring: React t-out netw)	
	0	No response
	1	Warning
	2	Trouble
	3	Fault
		If monitoring detects a time-out of the TCP communication with an existing TCP connection, the error response to be selected with this parameter occurs. The maximum permissible time-out of the TCP communication is defined in 0x23B1:010 (P510.10) . Associated error code: <ul style="list-style-type: none"> 33044 0x8114 - Network: overall communication timeout ► Error types






Address	Name / setting range / [default setting]		Information
0x2859:008 (P515.08)	Modbus TCP/IP monitoring: Fault reaction by time-out Master (MBTCP monitoring: React t-out mast)		Selection of the response if within the time set in 0x23B6:001 (P514.01) no valid message has arrived at the Modbus master. Associated error code: • 33046 0x8116 - Modbus TCP master time-out
	0	No response	▶ Error types
	1	Warning	
	2	Trouble	
	3	Fault	
0x2859:009 (P515.09)	Modbus TCP/IP monitoring: Fault reaction by time-out Keep alive (MBTCP monitoring: Reac t-out kp-al)		Selection of the response if within the time set in 0x23B6:002 (P514.02) 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
	1	Warning	
	2	Trouble	
	3	Fault	






3.13.5 Diagnostics

3.13.5.1 LED status display

Information on the CIP status can be obtained quickly via the "MS" and "NS" LED displays on the front of the inverter. In addition, the LEDs at the RJ45 sockets indicate the connection status.


The meaning of the "MS" and "NS" LEDs can be obtained from the following two tables.

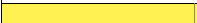
LED "MS" (green/red)	Module status	Status/meaning
off	Nonexistent	The network option is not supplied with voltage.
 On (green)	Operational	The network option works correctly.
 Blinking green	Standby	The network option is not configured completely or the configuration is incorrect.
 Blinking red	Major 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.

LED "NS" (green/red)	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 master.
 Blinking green	No connections	The network option <ul style="list-style-type: none"> • 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.

Status displays at the RJ45 sockets

The LEDs at the RJ45 sockets indicate the connection status to the network:

LED "Link" (green)	Status/meaning
off	No connection to the network.
 on	A physical connection to the network is available.

LED "Activity" (yellow)	Status/meaning
off	No data transfer.
 on or flickers	Data is exchanged via the network.

3.13.5.2 Information on the network

The following parameters serve to diagnose the communication activities between the inverter and the Modbus network.

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x23B2:001 (P511.01)	Active Modbus TCP settings: Active IP address (Act. MBTCP sett.: Act. IP address) • Read only	Display of the active IP address.

Address	Name / setting range / [default setting]	Information
0x23B2:002 (P511.02)	Active Modbus TCP settings: Active subnet (Act. MBTCP sett.: Act. subnet) • Read only	Display of the active subnet mask.
0x23B2:003 (P511.03)	Active Modbus TCP settings: Active gateway (Act. MBTCP sett.: Act. 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 (P511.05)	Active Modbus TCP settings: MAC address (Act. MBTCP sett.: MAC address) • Read only	Display of the active MAC address.
0x23B3 (P509.00)	Switch position (Switch position) • Read only	Display of the rotary encoder switch setting at the last mains power-on.
0x23B5:001 (P513.01)	Active port settings: Port 1 (Act. port sett.: Port 1) • Read only	Display of the baud rate set for Port 1 in 0x23B4:001 (P512.01) .
	0 Not connected	
	1 10 Mbps/Half Duplex	
	2 10 Mbps/Full Duplex	
	3 100 Mbps/Half Duplex	
	4 100 Mbps/Full Duplex	
0x23B5:002 (P513.02)	Active port settings: Port 2 (Act. port sett.: Port 2) • Read only	Display of the baud rate set for Port 2 in 0x23B4:001 (P512.01) .
	0 Not connected	
	1 10 Mbps/Half Duplex	
	2 10 Mbps/Full Duplex	
	3 100 Mbps/Half Duplex	
	4 100 Mbps/Full Duplex	
0x23B8 (P516.00)	Modbus TCP module status (MBTCP modul. stat) • Read only	Display of the TCP module state.
	0 Power off	
	1 Initialization	
	2 Warning	
	3 Fault	
	4 No configuration	
	5 Operational	
0x23B9 (P517.00)	Modbus TCP/IP network status (MBTCP netw stat) • Read only	Display of the active network status.
	0 No configuration	
	1 Initialization	
	2 Connection time-out	
	3 Configuration error	
	4 Not connected	
	5 Connection established	
0x23BA:001 (P580.01)	Modbus TCP statistics: Messages received (MBTCP statistics: Rx messages) • 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".

Address	Name / setting range / [default setting]	Information
0x23BA:002 (P580.02)	Modbus TCP statistics: Valid messages received (MBTCP statistics: Valid Rx messag.) • Read only	Display of the number of valid messages received. • After the maximum value has been reached, the counter starts again "0".
0x23BA:003 (P580.03)	Modbus TCP statistics: Messages with exceptions (MBTCP statistics: Mess. w. except) • 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 (P580.05)	Modbus TCP statistics: Messages sent (MBTCP statistics: Tx messages) • Read only	Display of the total number of messages sent. • After the maximum value has been reached, the counter starts again "0".
0x23BE:001 (P585.01)	Modbus TCP/IP diagnostics of last Rx/Tx data: Receive offset (MBTCP Tx/Rx diag: Rx offset) 0 ... [0] ... 240	For diagnostic purposes, the last received message (max. 16 bytes) is displayed in 0x23BE:002 (P585.02) . 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 (P585.02)	Modbus TCP/IP diagnostics of last Rx/Tx data: Last Rx message (MBTCP Tx/Rx diag: Last Rx message) • Read only	Display of the message received last.
0x23BE:003 (P585.03)	Modbus TCP/IP diagnostics of last Rx/Tx data: Transmit offset (MBTCP Tx/Rx diag: Tx offset) 0 ... [0] ... 240	For diagnostic purposes, the last sent message (max. 16 bytes) is displayed in 0x23BE:004 (P585.04) . 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 (P585.04)	Modbus TCP/IP diagnostics of last Rx/Tx data: Last Tx message (MBTCP Tx/Rx diag: Last Tx message) • Read only	Display of the message sent last.

3.14 PROFIBUS



PROFIBUS® (Process Field Bus) is a widely-used fieldbus system for the automation of machines and production plants.

- PROFIBUS® is a registered trademark and patented technology licensed by the PROFIBUS & PROFINET International (PI) user organisation.
- Detailed information on PROFIBUS can be found on the web page of the PROFIBUS & PROFINET International (PI) user organisation: <http://www.profibus.com>
- Information about the dimensioning of a PROFIBUS network can be found in the configuration document for the inverter.

Preconditions

- The control unit (CU) of the inverter is provided with PROFIBUS.
- The DIP switch for the node address is set correctly, see: ► [Basic setting and options](#)
- The device description file of the inverter is imported into the configuration software for the control.
 - [Download of the GSD file](#)

Details

The inverter is integrated into a PROFIBUS-DP network as slave. It is only allowed to receive and acknowledge messages and to respond to requests by a master. The master is also referred to as an active bus node. Two different types are distinguished:

- Class 1 DP master: central control (PLC or PC) which cyclically exchanges process data with the slave. Acyclic data exchange via a separate transmission channel is also possible.
- Class 2 DP master: engineering, configuration, or operator device (HMI) which only exchanges data with the slave acyclically, e.g. for the purposes of configuration, maintenance, or diagnostics.

Communication protocols (PROFIBUS DP)



PROFIBUS DP-V2 is not supported by the inverter.

Functions of the communication protocol PROFIBUS DP:

- DP-V0: cyclic data exchange, diagnostics (all devices).
- DP-V1: acyclic data exchange, process alarm processing (process automation). Note: The inverter does not support any alarm diagnostics.
- DP-V2: cycle synchronisation and time stamp, slave-to-slave communication.

A class 1 DP master connection (DPV1 C1) between a cyclic master and slave is established automatically when the "Data Exchange" state has been established. In byte 7 of the parameterisation frame, the "DPV1_Enable" bit must be set. Furthermore, a class 2 DP master connection (DPV1 C2) with the slave can be defined by another master connected. This connection must be established via the "MSAC2_Initiate" service.

The inverter supports the following acyclic DPV1 services:

- MSAC1_Read/Write: C1 read/write request for a data block.
- MSAC2_Initiate/Abort: connection or disconnection for acyclic data exchange between a class 2 DP master and the slave.
- MSAC2_Read/Write: C2 read/write request for a data block.

Communication time

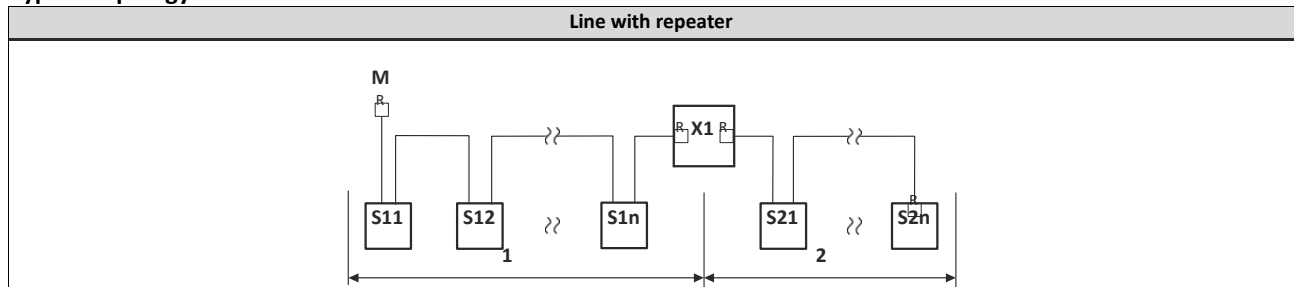
The communication time is the time between the start of a request and the arrival of the corresponding response.

The communication times in the PROFIBUS network depend on the ...

- processing time in the inverter
- Telegram runtime (baud rate/telegram length),
- nesting depth of the network.

In the case of the inverter, the processing time for process data is approx. 2 ... 3 ms, and for parameter data (DPV1) it is approx. 10 ms. There are no interdependencies between parameter data and process data.

Typical topology



M Master
S Slave

X Repeater
R Activated bus terminating resistor

3.14.1 Commissioning

In the following, the steps required for controlling the inverter via PROFIBUS are described.

Parameterization required

1. Activate network control: **0x2631:037 (P400.37)** = "TRUE [1]"
2. Set network as standard setpoint source: **0x2860:001 (P201.01)** = "Network [5]"
3. Set PROFIBUS station address.
 - Each network node must be provided with a unique station address.
 - See: [▶ Station address setting](#)
4. Optional: Change the response of the inverter if the communication to the PROFIBUS master is interrupted.
 - Default setting: If communication is interrupted, an error is triggered.
 - See: [▶ Monitoring](#)
5. Save parameter settings: **0x2022:003 (P700.03)** = "On / start [1]".
6. Switch the inverter off and then on again in order that the changed communication settings can get effective.
7. Configure the host system (master) in order to enable communication with the inverter.
See: [Configuring the host system \(master\)](#)
8. Control inverter via RPDO (and evaluate in the current status via TPDO).
 - For assignment of the control word and setpoint selection, see [▶ Define your own control word format](#).
 - For assignment of the status word and actual value output, see [▶ Define your own status word format](#).
 - Acceleration **0x2917 (P220.00)** and deceleration **0x2918 (P221.00)** can be set/changed via the acyclic parameter data transfer.



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](#)

Configuring the host system (master)

Configure the host system (master) with a configuration software as follows in order to enable communication with the inverter.

1. Import the device description file of the inverter into the master. [Download of the GSD file](#)
2. Define the user data length.
 - The user data length is defined during the initialization phase of the master.
 - The inverter supports the configuration of max. 16 process data words (max. 32 bytes).
 - The user data length for process input data and process output data is the same.
3. Adapt data mapping in the configuration software.
See: [▶ Standard mapping](#)
4. Save configuration.

Start-up of the host system (master)

- After the start-up, the master communicates the structure of the cyclic frames to the inverter (slave) via the configuration frame (CHK_CFG).
- The inverter checks the configuration. If the configuration is accepted, the inverter changes from the "Wait Configuration" state to the "Data Exchange" state. It is now possible to exchange user data with the master.
- The internal mapping of the process data is set in 0x24E0:001 ... 0x24E0:016 (direction Master → Inverter) and 0x24E1:001 ... 0x24E1:016 (direction Inverter → Master). Format: 0xiiii:ssll (iiii= Index hexadecimal, ss= subindex hexadecimal, ll= data length hexadecimal)

► Process data transfer

3.14.2 Basic setting and options

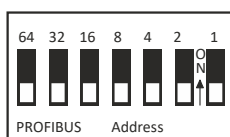
Station address setting

Each network node must be provided with a unique station address.

Details

- The station address of the inverter can be optionally set via the DIP switches on the device labelled with "1" ... "64" or in [0x2341:001 \(P510.01\)](#). (The DIP switches have priority.)
- The setting that is active when the inverter is switched on is the effective setting.
- The labelling of the DIP switches corresponds to the values of the individual DIP switches for determining the station address (see the following example).
- The active station address is shown in [0x2342:001 \(P511.01\)](#).

View of the DIP switch



Example of how the station address is set via the DIP switches

DIP switch	64	32	16	8	4	2	1
Setting	OFF	OFF	ON	OFF	ON	ON	ON
Value	0	0	16	0	4	2	1
Station address	= sum of all values = 16 + 4 + 2 + 1 = 23						

Parameter

Address	Name / setting range / [default setting]	Information
0x2341:001 (P510.01)	PROFIBUS settings: Station address (PROFIBUS sett.: Station address) 1 ... [3] ... 125	Optional setting of the station address (instead of setting via DIP switches 1 ... 64). <ul style="list-style-type: none">• The station address set here only becomes effective if DIP switches 1 ... 64 have been set to OFF before mains switching.• A change in the station address only becomes effective after a restart of PROFIBUS communication.

Baud rate setting

At the class 1 DP master, the desired baud rate is set. All masters at the bus must be set to the same baud rate.

Details

- The inverter detects the baud rate automatically.
- The active baud rate is displayed in [0x2342:002 \(P511.02\)](#).
- The status of automatic detection is displayed in [0x2348:002 \(P516.02\)](#).

Suppress diagnostic messages to the master

The alarm message on the master can be optionally suppressed for certain error responses of the inverter to facilitate suitable error handling between master and slave (inverter). Alarm responses programmed in the master can be avoided if they are not wanted in this case.

Details

Inverter errors and warnings are sent to the Master 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.

Parameter

Address	Name / setting range / [default setting]	Information
0x285A:001	Diagnostic configuration: Alarm suppression 0 ... [0] ... 65535	Bit coded selection of error responses in the inverter which suppress the alarm message to the PROFIBUS master. <ul style="list-style-type: none">• 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 2 -	
	Bit 3 Trouble	
	Bit 4 -	
	Bit 5 -	
	Bit 6 -	
	Bit 7 Fault	

3.14.3 Process data transfer

Data mapping is used to define which process data is exchanged cyclically between master and slave.

The data mapping is defined via the configuration software of the PROFIBUS master.

► Commissioning

The configuration of the process data is automatically sent to the inverter. The same applies to the bit configuration of the data words NetWordIN1 and NetWordOUT1.

Standard mapping RPDO mapping

For the process data from the master to the inverter, the following data mapping is preset in the device description file:

1. NetWordIN1 data word **0x4008:001 (P590.01)**
2. Network setpoint frequency (0.01) **0x400B:005 (P592.05)**
3. 16 bit selectable output data, mapped to: "Keypad setpoints: Process controller setpoint" **0x2601:002 (P202.02)**

Function assignment of the NetWordIN1 data word

Bit	Default setting	For details and configuration, see
0	Not active (reserve)	0x400E:001 (P505.01)
1	Not active (reserve)	0x400E:002 (P505.02)
2	Activate quick stop	0x400E:003 (P505.03)
3	Not active (reserve)	0x400E:004 (P505.04)
4	Run forward (CW)	0x400E:005 (P505.05)
5	Activate preset (bit 0)	0x400E:006 (P505.06)
6	Activate preset (bit 1)	0x400E:007 (P505.07)
7	Reset error	0x400E:008 (P505.08)
8	Not active (reserve)	0x400E:009 (P505.09)
9	Activate DC braking	0x400E:010 (P505.10)
10	Not active (reserve)	0x400E:011 (P505.11)
11	Not active (reserve)	0x400E:012 (P505.12)
12	Reverse rotational direction	0x400E:013 (P505.13)
13	Not active (reserve)	0x400E:014 (P505.14)
14	Not active (reserve)	0x400E:015 (P505.15)
15	Not active (reserve)	0x400E:016 (P505.16)

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

For the process data from the inverter to the master, the following data mapping is preset in the device description file:

1. **NetWordOUT1 data word 0x400A:001 (P591.01)**
2. **Network setpoint frequency (0.01) 0x400B:005 (P592.05)**
3. **Motor current 0x2D88 (P104.00)**

Status assignment of the NetWordOUT1 data word

Bit	Default setting	For details and configuration, see
0	Ready for operation	0x2634:010 (P420.10)
1	Not connected	0x2634:011 (P420.11)
2	Operation enabled	0x2634:012 (P420.12)
3	Fault active	0x2634:013 (P420.13)
4	Not connected	0x2634:014 (P420.14)
5	Quick stop active	0x2634:015 (P420.15)
6	Running	0x2634:016 (P420.16)
7	Device warning active	0x2634:017 (P420.17)
8	Not connected	0x2634:018 (P420.18)
9	Not connected	0x2634:019 (P420.19)
10	Setpoint speed reached	0x2634:020 (P420.20)
11	Current limit reached	0x2634:021 (P420.21)
12	Actual speed = 0	0x2634:022 (P420.22)
13	Rotational direction reversed	0x2634:023 (P420.23)
14	Release holding brake	0x2634:024 (P420.24)
15	Inverter disabled (safety)	0x2634:025 (P420.25)

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

Parameter

Address	Name / setting range / [default setting]	Information
0x24E0:000	Generic RPDO mapping: Highest subindex 0 ... [2] ... 16	Number of mapping entries for RPDO.
0x24E0:001	Generic RPDO mapping: Entry 1 0x00000000 ... [0x60400010] ... 0xFFFFFFFF	Mapping entry 1 for RPDO.
0x24E0:002	Generic RPDO mapping: Entry 2 0x00000000 ... [0x60420010] ... 0xFFFFFFFF	Mapping entry 2 for RPDO.
0x24E0:003	Generic RPDO mapping: Entry 3 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 3 for RPDO.
0x24E0:004	Generic RPDO mapping: Entry 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for RPDO.
0x24E0:005	Generic RPDO mapping: Entry 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for RPDO.
0x24E0:006	Generic RPDO mapping: Entry 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for RPDO.
0x24E0:007	Generic RPDO mapping: Entry 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for RPDO.
0x24E0:008	Generic RPDO mapping: Entry 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for RPDO.

Address	Name / setting range / [default setting]	Information
0x24E0:009	Generic RPDO mapping: Entry 9 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 9 for RPDO.
0x24E0:010	Generic RPDO mapping: Entry 10 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 10 for RPDO.
0x24E0:011	Generic RPDO mapping: Entry 11 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 11 for RPDO.
0x24E0:012	Generic RPDO mapping: Entry 12 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 12 for RPDO.
0x24E0:013	Generic RPDO mapping: Entry 13 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 13 for RPDO.
0x24E0:014	Generic RPDO mapping: Entry 14 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 14 for RPDO.
0x24E0:015	Generic RPDO mapping: Entry 15 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 15 for RPDO.
0x24E0:016	Generic RPDO mapping: Entry 16 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 16 for RPDO.
0x24E1:000	Generic TPDO mapping: Highest subindex 0 ... [3] ... 16	Number of mapping entries for TPDO.
0x24E1:001	Generic TPDO mapping: Entry 1 0x00000000 ... [0x60410010] ... 0xFFFFFFFF	Mapping entry 1 for TPDO.
0x24E1:002	Generic TPDO mapping: Entry 2 0x00000000 ... [0x60440010] ... 0xFFFFFFFF	Mapping entry 2 for TPDO.
0x24E1:003	Generic TPDO mapping: Entry 3 0x00000000 ... [0x603F0010] ... 0xFFFFFFFF	Mapping entry 3 for TPDO.
0x24E1:004	Generic TPDO mapping: Entry 4 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 4 for TPDO.
0x24E1:005	Generic TPDO mapping: Entry 5 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 5 for TPDO.
0x24E1:006	Generic TPDO mapping: Entry 6 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 6 for TPDO.
0x24E1:007	Generic TPDO mapping: Entry 7 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 7 for TPDO.
0x24E1:008	Generic TPDO mapping: Entry 8 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 8 for TPDO.
0x24E1:009	Generic TPDO mapping: Entry 9 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 9 for TPDO.
0x24E1:010	Generic TPDO mapping: Entry 10 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 10 for TPDO.
0x24E1:011	Generic TPDO mapping: Entry 11 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 11 for TPDO.
0x24E1:012	Generic TPDO mapping: Entry 12 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 12 for TPDO.

Address	Name / setting range / [default setting]	Information
0x24E1:013	Generic TPDO mapping: Entry 13 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 13 for TPDO.
0x24E1:014	Generic TPDO mapping: Entry 14 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 14 for TPDO.
0x24E1:015	Generic TPDO mapping: Entry 15 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 15 for TPDO.
0x24E1:016	Generic TPDO mapping: Entry 16 0x00000000 ... [0x00000000] ... 0xFFFFFFFF	Mapping entry 16 for TPDO.

3.14.4 Parameter data transfer

Data communication with PROFIBUS DP-V0 is characterised by cyclic diagnostics and cyclic process data transfer. An optional service expansion is the acyclic parameter data transfer of PROFIBUS DP-V1. This service does not impair the functionality of the PROFIBUS standard services under PROFIBUS DP-V0.

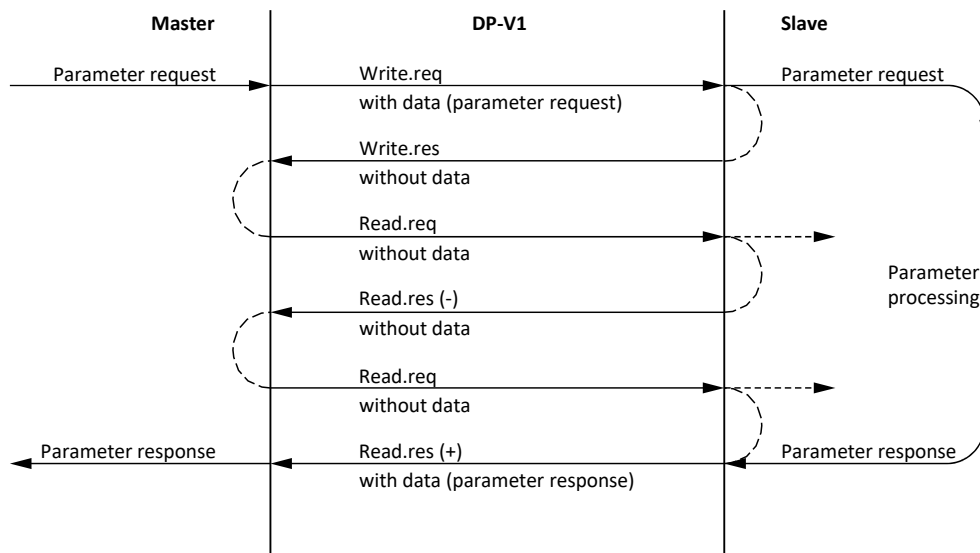
Details

- PROFIBUS DP-V0 and PROFIBUS DP-V1 can be operated simultaneously in the same network. This enables the expansion or modification of a system.
- The services of PROFIBUS DP-V1 can be used by the class 1 master (PLC) and the class 2 DP master (diagnostics master, etc.).
- Integration of the acyclic service into the fixed bus cycle depends on the corresponding configuration of the class 1 master:
 - With configuration, a time slot is reserved.
 - Without configuration, the acyclic service is appended when a class 2 DP master acyclically accesses a DP-V1 slave.

Features

- 16 bits each for addressing the parameter index and subindex.
- Several parameter requests can be combined to one request (multi-parameter requests).
- Only one request is processed at a time (no pipelining).
- A request or response must fit into one data block (max. 240 bytes). Requests or responses cannot be split into several data blocks.
- No spontaneous messages are transferred.
- There are only acyclic parameter requests.
- Profile-specific parameters can be read independently of the slave state.
- A class 1 DP master can always request parameters from a slave if the slave is in the "Data Exchange" state.
- In addition to a class 1 DP master, a class 2 DP master can establish communication with a slave:

Transmission directions for acyclic data transfer



Procedure:

1. A "Write.req" is used to pass the data set (DB47) to the slave in the form of a parameter request.
2. With "Write.res" the master receives the confirmation for the receipt of the message.
3. The master requests the response of the slave with "Read.req".
4. The slave responds with "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 master with "Read.res (+)".

Frame structure

SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	Data Unit (DU)	FCS	ED
----	----	-----	----	----	----	----	------	------	-----------------------	-----	----

The Data Unit (DU) contains the DP-V1 header and the parameter request or the parameter response. The DP V1 header consists of the function detection, slot number, data set, and the length of the user data. More information about the DP-V1 header can be found in the corresponding PROFIBUS specification. A detailed description of the parameter request and parameter response can be found in the following subchapters.

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	<i>Data</i> (x bytes)				
U8	1 byte	<i>Data</i>	0x00			
U16	2 bytes	HIGH byte <i>Data</i>	LOW byte <i>Data</i>			
U32	4 bytes	HIGH word HIGH byte <i>Data</i>		LOW word HIGH byte <i>Data</i>		LOW byte <i>Data</i>

3.14.4.1 Read parameter data acyclically

This section describes the request and response for the acyclic reading of a parameter.

Details

- When a read request is processed, no parameter value is written to the slave.
- When a read request is transmitted by multi-parameters, the parameter attribute, index and subindex are repeated.
- A read request must not exceed the maximum data length of 240 bytes.

Request header

Byte 1	Byte 2	Byte 3	Byte 4
Request reference	Request identification	Axis	Number of indices

Field	Data type	Values
Request reference	U8	This value is defined by the master.
Request identification	U8	0x01: Request parameters for reading.
Axis	U8	0x00 or 0x01
Number of indices	U8	0x"n" (n = number of parameters requested)

Parameter attribute

Byte 5	Byte 6
Attribute	Number of subindices

Field	Data type	Values
Attribute	U8	0x10: Value
Number of subindices	U8	0x00

Index and subindex

Byte 7	Byte 8	Byte 9	Byte 10
Index		Subindex	
HIGH byte	LOW byte	HIGH byte	LOW byte

Field	Data type	Values
Index	U16	0x0001 ... 0xFFFF (1 ... 65535)
Subindex	U16	0x0000 ... 0x00FF (0 ... 255)

Response to a correctly executed read request

Responses to a read request do not contain parameter attributes, indices and subindices.

Response header

Byte 1	Byte 2	Byte 3	Byte 4
Request reference (mirrored)	Response identification	Axis (mirrored)	Number of indices

Field	Data type	Values
Request reference	U8	Mirrored value of the parameter request.
Response identification	U8	0x01: Parameter has been read.
Axis	U8	0x00 or 0x01
Number of indices	U8	0x"n" (n = number of parameters requested)

Parameter format

Byte 5	Byte 6	
Format	Number of values	
Field	Data type	Values
Format	U8	0x02: integer8 (1 byte with sign) 0x03: Integer16 (2 bytes with sign) 0x04: Integer32 (4 bytes with sign) 0x05: Unsigned8 (1 byte without sign) 0x06: Unsigned16 (2 bytes without sign) 0x07: Unsigned32 (4 bytes without sign) 0x09: Visible String (with n characters) 0x0A: Octet String (with n characters) 0x40: Zero 0x41: Byte 0x42: Word 0x43: Double word
Number of values	U8	0x01 or number of characters (n) for string parameters.

Parameter value

Byte 7	Byte 8	Byte 9	Byte 10
Value (Integer8 / Unsigned8 / byte)			
Value (Integer16 / Unsigned16 / word)			
Value (Integer32 / Unsigned32 / double word)			

Byte 7	Byte 8	Byte 9	Byte ...
String (Visible string / octet string with an optional length)			

Field	Data type	Values
Value	U8/U16/U32	Value range/length depends on the parameter format (see table above).
String	U8	Visible string / octet string with an optional length (n characters = n bytes)

Response to a read error

In the case of a multi-parameter request, correct and possible faulty messages are summarised in one telegram. They have the following data contents:

Correct message

- Format: data type of the value requested
- Number of values: as described above.
- Parameter value: value requested

Faulty message

- Format: 0x44
- Number of values: 0x01 or 0x02
- Error code without additional information (for number of values = 0x01) or error code with additional information (for number of values = 0x02)

A faulty access to a parameter "n" is indicated at the nth position in the response telegram of a multi-parameter request.

Response header

Byte 1	Byte 2	Byte 3	Byte 4
Request reference (mirrored)	Response identification	Axis (mirrored)	Number of indices

Field	Data type	Values
Request reference	U8	Mirrored value of the parameter request.
Response identification	U8	0x81: Parameter has not been read. The data in bytes 7 + 8 must be interpreted as an error code.
Axis	U8	0x00 or 0x01
Number of indices	U8	0x"n" (n = number of parameters requested)

Parameter format

Byte 5	Byte 6	
Format	Number of values	

Field	Data type	Values
Format	U8	0x44: Error
Number of values	U8	0x01: Error code without additional information. 0x02: Error code with additional information.

Error code

Byte 7	Byte 8	Byte 9	Byte 10
Error code		Additional information (if available)	
HIGH byte	LOW byte	HIGH byte	LOW byte

Field	Data type	Values
Error code	U16	0x0000 ... 0xFFFF
Additional information (if available)	U16	

3.14.4.2 Write parameter data acyclically

This section describes the request and response for the acyclic writing of a parameter.

Details

- When a multi-parameter write request is transmitted, the parameter attribute, index and subindex and then the parameter format and parameter value are repeated "n" times, "n" being the number of parameters addressed.
- A write request must not exceed the maximum data length of 240 bytes.

Request header

Byte 1	Byte 2	Byte 3	Byte 4
Request reference	Request identification	Axis	Number of indices

Field	Data type	Values
Request reference	U8	This value is defined by the master.
Request identification	U8	0x02: Write parameters.
Axis	U8	0x00 or 0x01
Number of indices	U8	0x"n" (n = number of parameters addressed)

Parameter attribute

Byte 5	Byte 6
Attribute	Number of subindices

Field	Data type	Values
Attribute	U8	0x10: Value
Number of subindices	U8	0x00

Index and subindex

Byte 7	Byte 8	Byte 9	Byte 10
Index		Subindex	
HIGH byte	LOW byte	HIGH byte	LOW byte

Field	Data type	Values
Index	U16	0x0001 ... 0xFFFF (1 ... 65535)
Subindex	U16	0x0000 ... 0x00FF (0 ... 255)

Parameter format

Byte 11	Byte 12
Format	Number of values

Field	Data type	Values
Format	U8	0x02: integer8 (1 byte with sign) 0x03: Integer16 (2 bytes with sign) 0x04: Integer32 (4 bytes with sign) 0x05: Unsigned8 (1 byte without sign) 0x06: Unsigned16 (2 bytes without sign) 0x07: Unsigned32 (4 bytes without sign) 0x09: Visible String (with n characters) 0x0A: Octet String (with n characters) 0x40: Zero 0x41: Byte 0x42: Word 0x43: Double word
Number of values	U8	0x01 or number of characters (n) for string parameters.

Parameter value

Byte 13	Byte 14	Byte 15	Byte 16
Value (Integer8 / Unsigned8 / byte)			
Value (Integer16 / Unsigned16 / word)			
Value (Integer32 / Unsigned32 / double word)			
Byte 13	Byte 14	Byte 15	Byte ...
String (Visible string / octet string with an optional length)			
Field	Data type	Values	
Value	U8/U16/U32	Value range/length depends on the parameter format (see table above).	
String	U8	Visible string / octet string with an optional length (n characters = n bytes)	

Response to a correctly executed write request

With an error-free multi-parameter request, only the response header is transmitted, and the complete data area is omitted.

Response header

Byte 1	Byte 2	Byte 3	Byte 4
Request reference (mirrored)	Response identification	Axis (mirrored)	Number of indices
Field	Data type	Values	
Request reference	U8	Mirrored value of the parameter request.	
Response identification	U8	0x02: Parameter has been written.	
Axis	U8	0x00 or 0x01	
Number of indices	U8	0x"n" (n = number of parameters addressed)	

Response to a write error

In the case of a multi-parameter request, correct and possible faulty messages are summarised in one telegram. They have the following data contents:

Correct message

- Format: 0x40
- Number of values: 0x00

Faulty message

- Format: 0x44
- Number of values: 0x01 or 0x02
- Error code without additional information (for number of values = 0x01) or error code with additional information (for number of values = 0x02)

A faulty access to a parameter "n" is indicated at the nth position in the response telegram of a multi-parameter request.

Response header

Byte 1	Byte 2	Byte 3	Byte 4
Request reference (mirrored)	Response identification	Axis (mirrored)	Number of indices
Field	Data type	Values	
Request reference	U8	Mirrored value of the parameter request.	
Response identification	U8	0x82: Parameter has not been written. The data in bytes 7 + 8 must be interpreted as an error code.	
Axis	U8	0x00 or 0x01	
Number of indices	U8	0x"n" (n = number of parameters addressed)	

Parameter format

Byte 5	Byte 6	
Format	Number of values	

Field	Data type	Values
Format	U8	0x44: Error
Number of values	U8	0x01: Error code without additional information. 0x02: Error code with additional information.

Error code

Byte 7	Byte 8	Byte 9	Byte 10
Error code		Additional information (if available)	
HIGH byte	LOW byte	HIGH byte	LOW byte

Field	Data type	Values
Error code	U16	0x0000 ... 0xFFFF
Additional information (if available)	U16	

3.14.4.3 Error codes

The following table lists all possible error codes for the acyclic data exchange:

Error code	Description	Explanation	Additional information
0x0000	Parameter number impermissible	Access to non-available parameter.	-
0x0001	Parameter value cannot be changed	Change access to a parameter value that cannot be changed.	Subindex
0x0002	Lower or upper value limit exceeded	Change access with value beyond the value limits.	Subindex
0x0003	Subindex impermissible	Access to non-available subindex.	Subindex
0x0004	No array	Access with subindex to non-indicated parameter.	-
0x0005	Incorrect data type	Change access with value that does not match the data type of the parameter.	-
0x0006	No setting permitted (only resettable)	Change access with a non-zero value where it is not permitted.	Subindex
0x0007	Description element cannot be changed	Change access to a description element that cannot be changed.	Subindex
0x0008	Reserved	(PROFIdrive profile V2: PPO-Write requested in IR is not available.)	-
0x0009	Description data not available	Access to non-available description (parameter value is available).	-
0x000A	Reserved	(PROFIdrive profile V2: Wrong access group.)	-
0x000B	No parameter change rights	Change access with missing parameter change rights.	-
0x000C	Reserved	(PROFIdrive profile V2: Wrong password.)	-
0x000D	Reserved	(PROFIdrive profile V2: Text cannot be read in cyclic data transfer.)	-
0x000E	Reserved	(PROFIdrive profile V2: Name cannot be read in cyclic data transfer.)	-
0x000F	No text array available	Access to non-available text array (parameter value is available).	-
0x0010	Reserved	(PROFIdrive profile V2: No PPO-Write.)	-
0x0011	Request cannot be executed due to the operating state	Access is not possible for temporary reasons that are not specified in detail.	-
0x0012	Reserved	(PROFIdrive profile V2: Other error.)	-
0x0013	Reserved	(PROFIdrive profile V2: Date cannot be read in cyclic data transfer.)	-
0x0014	Value impermissible	Change access with the value that is within the value limits but that is impermissible for other permanent reasons (parameters with defined individual values).	Subindex
0x0015	Response too long	The length of the current response exceeds the maximum length transferrable.	-
0x0016	Parameter address impermissible	Impermissible value or value which is not supported for the attribute, number of subindexes, parameter number, or subindex, or a combination.	-
0x0017	Format impermissible	Write request: Impermissible or non-supported format of parameter data.	-
0x0018	Number of values not consistent	Write request: Number of parameter data values does not match the number of subindexes in the parameter address.	-
0x0019	Axis impermissible	Access to non-available axis. For double axis, only 0x00 or 0x01 permitted.	-
0x001A	Reserved	-	-
...			
0x00FF			

3.14.6 Monitoring

The inverter can give a parameterisable response to various PROFIBUS errors.

Details

The following table lists the PROFIBUS errors that can be set for a response.

Event	Display in	Response can be set in	Default setting
Communication to the PROFIBUS master is continuously interrupted.	0x2349 (P517.00), Bit 0	0x2859:001 (P515.01)	Fault
Data exchange via PROFIBUS has been terminated.	0x2349 (P517.00), Bit 1	0x2859:002 (P515.02)	No response
The inverter has received invalid configuration data from the master.	0x2349 (P517.00), Bit 2	0x2859:003 (P515.03)	Fault
An error has occurred during the initialisation of the PROFIBUS interface.	0x2349 (P517.00), Bit 3	0x2859:004 (P515.04)	Fault
The process data received are invalid.	0x2349 (P517.00), Bit 4	0x2859:005 (P515.05)	Trouble

The parameters for setting network monitoring functions are described below.

Parameter








Address	Name / setting range / [default setting]	Information
0x2859:001 (P515.01)	PROFIBUS monitoring: Watchdog elapsed (PROFIBUS monit.: WD elapsed)	Selection of the response to the continuous interruption of communication to the PROFIBUS master, e. g. by cable break or failure of the PROFIBUS master. Associated error code: • 33168 0x8190 - Network: watchdog timeout
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:002 (P515.02)	PROFIBUS monitoring: Data exchange exited (PROFIBUS monit.: Data exch.exited)	Selection of the response to exiting the "Data Exchange" state. Associated error code: • 33169 0x8191 - Network: disruption of cyclic dataexchange
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:003 (P515.03)	PROFIBUS monitoring: Invalid configuration (PROFIBUS monit.: Invalid config)	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
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:004 (P515.04)	PROFIBUS monitoring: Initialisation error (PROFIBUS monit.: Init. error)	Selection of the response triggered by the occurrence of an error during the initialisation of the PROFIBUS module. Associated error code: • 33170 0x8192 - Network: initialisation error
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:005 (P515.05)	PROFIBUS monitoring: Invalid process data (PROFIBUS monit.: Inval. proc.data)	Selection of the response triggered by the reception of invalid process data. • If the master changes to the "Stop" state, no cyclic process data are sent to the inverter (slave) anymore; the length of the process data then is 0. Associated error code: • 33171 0x8193 - Network: invalid cyclic process data
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	

3.14.7 Diagnostics

3.14.7.1 LED status display

Information about the PROFIBUS status can be obtained quickly via the "NS" and "NE" LED displays on the front of the inverter.

The meaning can be seen from the table below.

LED "NS" (green)	LED "NE" (red)	Status/meaning
off	off	No supply voltage available, network deactivated, not initialised, or firmware download active.
 on		Connected with master, control running, "Data Exchange" state active.
 blinking		Not connected, control stopped, or no data exchange.
 blinking	 blinking	Watchdog monitoring time elapsed.
Any	 Flashing	PROFIBUS parameterisation error.
	 Flashing 2 x	PROFIBUS configuration error.
off	 on	Invalid station address set or non-correctable error.

3.14.7.2 Information on the network

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x2342:001 (P511.01)	Active PROFIBUS settings: Active station address (PROFIBUS diag.: Act.station addr) • Read only	Display of the active station address.
0x2342:002 (P511.02)	Active PROFIBUS settings: Active baud rate (PROFIBUS diag.: Active baud rate) • Read only	Display of the active baud rate.
	0 12 Mbps	
	1 6 Mbps	
	2 3 Mbps	
	3 1.5 Mbps	
	4 500 kbps	
	5 187.5 kbps	
	6 93.75 kbps	
	7 45.45 kbps	
	8 19.2 kbps	
	9 9.6 kbps	
	15 Search	Automatic baud rate detection active.
0x2342:003 (P511.03)	Active PROFIBUS settings: Watchdog time (PROFIBUS diag.: Watchdog time) • Read only	Display of the watchdog monitoring time specified by the master. • Monitoring starts with the arrival of the first telegram. • When a value of "0" is displayed, the monitoring function is deactivated. • A change in the watchdog monitoring time in the master is effective immediately.
0x2343 (P509.00)	PROFIBUS switch position (PROFIBUS switch) • Read only	Display of the DIP switch setting at the last mains power-on. • The displayed value corresponds to the sum of the individual DIP switch values 1 ... 64.
0x2344:001 (P512.01)	PROFIBUS Configuration: Extended diagnostic bit (PROFIBUS Config.: Ext. diag. bit)	1 = set external diagnostic bit ("Diag Bit"). • The diagnostic bit is sent to the master where it is evaluated separately.
	0 Delete	
	1 Set	

Address	Name / setting range / [default setting]	Information
0x2348:001 (P516.01)	PROFIBUS Status: Bus status (PROFIBUS Status: Bus status) • Read only	Display of the current DP state machine state (DP-STATE).
	0 WAIT_PRM	After the run-up, the inverter (slave) is waiting for parameter data (CHK_PRM) from the master. All other frame types are not processed. Exchanging user data with the master is not possible yet.
	1 WAIT_CFG	The inverter (slave) is waiting for configuration data (CHK_CFG) from the master that define the structure of the cyclic frames.
	2 DATA_EXCH	Parameter and configuration data have been received and accepted by the inverter (slave). The inverter is in the "Data Exchange" state. It is now possible to exchange user data with the master.
0x2348:002 (P516.02)	PROFIBUS Status: Watchdog status (PROFIBUS Status: Watchdog status) • Read only	Display of the current state of the watchdog state machine (WD-STATE).
	0 BAUD_SEARCH	The inverter (slave) is able to detect the baud rate automatically.
	1 BAUD_CONTROL	After detecting the correct baud rate, the inverter (slave) status changes to BAUD_CONTROL, and the baud rate is monitored.
	2 DP_CONTROL	The DP_CONTROL state serves to the response monitoring of the master.
0x2349 (P517.00)	PROFIBUS error (PROFIBUS error) • Read only	Bit-coded display of PROFIBUS errors.
	Bit 0 Watchdog elapsed	Communication with the PROFIBUS master is continuously interrupted, e. g. by cable break or failure of the PROFIBUS master. • No process data are sent to the inverter (slave) in the "Data Exchange" state. • When the watchdog monitoring time specified by the master has elapsed, the response set in 0x2859:001 (P515.01) is triggered in the inverter. Preconditions for a response by the inverter (slave): • The slave is in the "Data Exchange" state. • The watchdog monitoring time is configured correctly in the master (1 ... 65535 ms). If one of these preconditions is not met, the response to the absence of cyclic process data telegrams from the master is not executed.
	Bit 1 Data exchange completed	Data exchange via PROFIBUS has been terminated. • The inverter (slave) can be instructed by the master to exit the "Data Exchange" state. • If this state change is to be treated as an error in the inverter, the desired response can be set in 0x2859:002 (P515.02) .
	Bit 2 Incorrect configuration data	The inverter (slave) has received invalid configuration data from the master. • The response set in 0x2859:003 (P515.03) is effected.
	Bit 3 Initialisation error	An error has occurred during the initialisation of the PROFIBUS interface. • The response set in 0x2859:004 (P515.04) is effected.
	Bit 4 Invalid process data	The inverter (slave) has received invalid process data from the master, e.g. no process data or deleted process data are sent by the "Stop" operating status in the master. • The response set in 0x2859:005 (P515.05) is effected.
0x234A:001 (P580.01)	PROFIBUS statistics: Data cycles per second (PROFIBUS counter: Data cycles/sec.) • Read only	Display of the data cycles per second.
0x234A:002 (P580.02)	PROFIBUS statistics: Parameterization events (PROFIBUS counter: PRM events) • Read only	Display of the number of parameterisation events.
0x234A:003 (P580.03)	PROFIBUS statistics: Configuration events (PROFIBUS counter: CFG events) • Read only	Display of the number of configuration events.
0x234A:004 (P580.04)	PROFIBUS statistics: Diagnostics events (PROFIBUS counter: DIAG events) • Read only	Display of the number of diagnostic telegrams sent.
0x234A:005 (P580.05)	PROFIBUS statistics: C1 messages (PROFIBUS counter: C1 messages) • Read only	Display of the number of requests by the class 1 DPV1 master.

Address	Name / setting range / [default setting]	Information
0x234A:006 (P580.06)	PROFIBUS statistics: C2 messages (PROFIBUS counter: C2 messages) • Read only	Display of the number of requests by the class 2 DPV1 master.
0x234A:007 (P580.07)	PROFIBUS statistics: Watchdog events (PROFIBUS counter: WD events) • Read only	Display of the number of watchdog events.
0x234A:008 (P580.08)	PROFIBUS statistics: Data exchange aborts (PROFIBUS counter: DataEx.event) • Read only	Display of the number of "Data Exchange exited" events.
0x234A:009 (P580.09)	PROFIBUS statistics: Total data cycles (PROFIBUS counter: Tot. data cycles) • Read only	Display of the number of cyclic process data received.

3.15 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.

Preconditions

- The control unit (CU) of the inverter is provided with 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

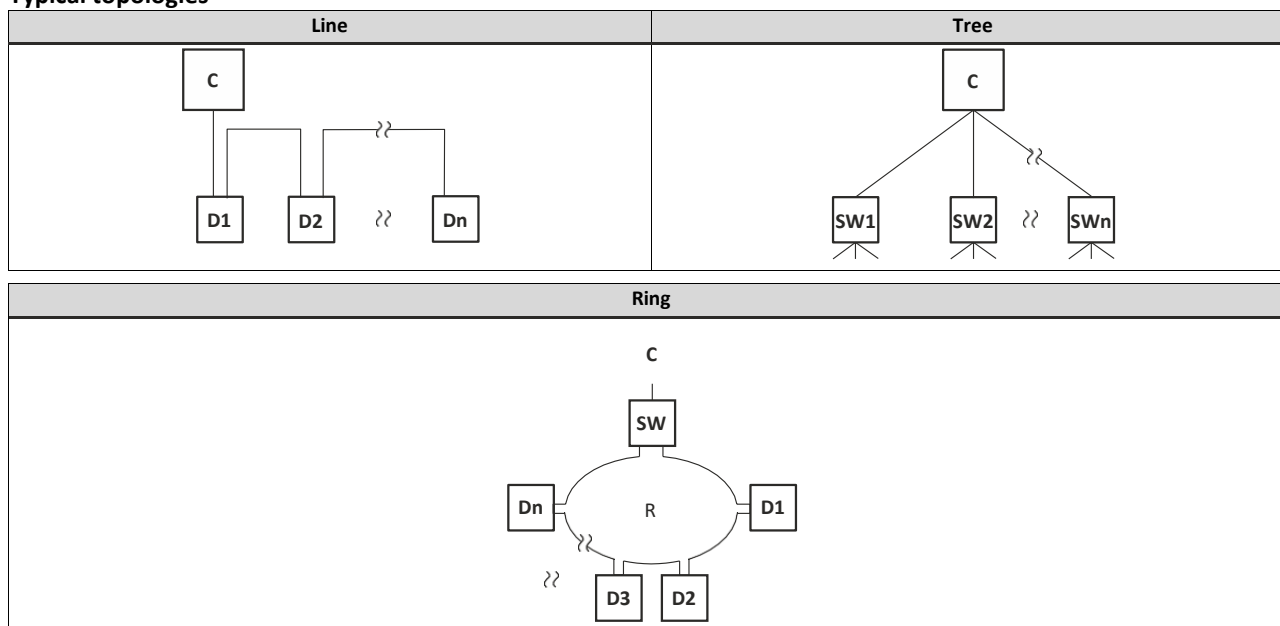
- PROFINET is connected via the RJ45 sockets. **X2x6** and **X2x7**.
- An Ethernet cable CAT 5/5e can be used for the connection to the network, 2-pair with AWG22 (American Wire Gauge) or 4-pair with AWG22/24.



More information about connections can be found on the Internet:

www.profibus.org → PROFINET Cabling and Interconnection Technology

Typical topologies



C IO controller
D IO device

SW Switch SCALANCE (MRP capable)
R Redundant domain

3.15.1 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](#)

- 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 »Remote Sinus«.
 - [Download »Remote Sinus«](#)
- 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](#)



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 »Remote Sinus«

1. **Activate network control:** **0x2631:037 (P400.37) = "TRUE [1]"**
2. **Set network as standard setpoint source:** **0x2860:001 (P201.01) = "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](#)

3. **Set the IP address and the station name ("PROFINET device name").** See: [► Station name and IP configuration](#)
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 (P700.03) with mains failure protection.**

See: [► Saving the parameter settings](#)

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 an Enertronica Santerno engineering tool (e. g. »Remote Sinus«) 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 »Remote Sinus«.

Use the [0x2022:003 \(P700.03\)](#) parameter to save the settings. More information: [▶ Saving the parameter settings](#)

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 \(P505.05\)](#)).
 - 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 \(P700.03\)](#) with mains failure protection, see [▶ Saving the parameter settings](#)

Restart or stop communication

The **0x2380 (P508.00)** 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 (P508.00) Set = 1 (Restart with current values).**

3.15.1.1 Restarting or stopping the communication Restart or stop communication

The **0x2380 (P508.00)** 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 (P508.00) = 1 (Restart with current values).**

Parameter

Address	Name / setting range / [default setting]	Information
0x2380 (P508.00)	PROFINET communication (PROFINET comm.)	Restart / stop communication <ul style="list-style-type: none">• 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).
	5 Stop network communication	Stop communication
	10 In progress	Only status feedback
	11 Action cancelled	
	12 Fault	

3.15.1.2 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](#)

3.15.2 Basic setting and options

3.15.2.1 Station name and IP configuration

The station name and the IP configuration can be assigned by the IO-Controller. These settings enable the IO-Controller to 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 \(P510.04\)](#)
- Display of the currently used station name: ▶ [0x2382:004 \(P511.04\)](#)
- The IP configuration comprises the assignments of:
 - IP address ▶ [0x2381:001 \(P510.01\)](#)
 - Subnet mask ▶ [0x2381:002 \(P510.02\)](#)
 - Gateway address ▶ [0x2381:003 \(P510.03\)](#)
- Display of the actual IP configuration: ▶ [0x2382:001 \(P511.01\)](#) ... [0x2382:003 \(P511.03\)](#)



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 \(P700.03\)](#)

▶ [Saving the parameter settings](#)



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](#)

Parameter

Address	Name / setting range / [default setting]	Information
0x2381:001 (P510.01)	PROFINET settings: IP address (PROFINET sett.: IP address) 0.0.0.0 ... [0.0.0.0] ... 255.255.255.255	Set IP address <ul style="list-style-type: none">• A changed value will only be effective after the PROFINET communication is restarted (0x2380 (P508.00) = 1).
0x2381:002 (P510.02)	PROFINET settings: Subnet (PROFINET sett.: Subnet) 0.0.0.0 ... [0.0.0.0] ... 255.255.255.255	Set subnet mask <ul style="list-style-type: none">• A changed value will only be effective after the PROFINET communication is restarted (0x2380 (P508.00) = 1).
0x2381:003 (P510.03)	PROFINET settings: Gateway (PROFINET sett.: Gateway) 0.0.0.0 ... [0.0.0.0] ... 255.255.255.255	Set gateway address <ul style="list-style-type: none">• A changed value will only be effective after the PROFINET communication is restarted (0x2380 (P508.00) = 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 (P510.04)	PROFINET settings: Station name (PROFINET sett.: Stationsname)	Set station name <ul style="list-style-type: none">• A changed value will only be effective after the PROFINET communication is restarted (0x2380 (P508.00) = 1).
0x2381:005	PROFINET settings: I&M1 System designation	Input/output of the I&M1 system designation <ul style="list-style-type: none">• The default setting is an empty string.
0x2381:006	PROFINET settings: I&M1 Installation site	Input/output of the I&M1 location identification code <ul style="list-style-type: none">• The default setting is an empty string.
0x2381:007	PROFINET settings: I&M2 Installation date	Input/output of the I&M2 date of installation <ul style="list-style-type: none">• The default setting is an empty string.
0x2381:008	PROFINET settings: I&M3 additional information	Input/output of the I&M3 additional information <ul style="list-style-type: none">• The default setting is an empty string.
0x2381:009	PROFINET settings: I&M4 signature code	Input/output of the I&M4 signature <ul style="list-style-type: none">• The default setting is an empty string.

3.15.2.2 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. <ul style="list-style-type: none">• 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	

3.15.3 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: [0x24E0:001 ... 0x24E0:016](#)
- Internal mapping of the process input data: [0x24E1:001 ... 0x24E1:016](#)



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 \(P590.01\)](#)
2. **Network setpoint frequency (0.01)** [0x400B:005 \(P592.05\)](#)
3. **16 bit selectable output data, mapped to: "Keypad setpoints: Process controller setpoint"** [0x2601:002 \(P202.02\)](#)

Function assignment of the NetWordIN1 data word

Bit	Default setting	For details and configuration, see
0	Not active (reserve)	0x400E:001 (P505.01)
1	Not active (reserve)	0x400E:002 (P505.02)
2	Activate quick stop	0x400E:003 (P505.03)
3	Not active (reserve)	0x400E:004 (P505.04)
4	Run forward (CW)	0x400E:005 (P505.05)
5	Activate preset (bit 0)	0x400E:006 (P505.06)
6	Activate preset (bit 1)	0x400E:007 (P505.07)
7	Reset error	0x400E:008 (P505.08)
8	Not active (reserve)	0x400E:009 (P505.09)
9	Activate DC braking	0x400E:010 (P505.10)
10	Not active (reserve)	0x400E:011 (P505.11)
11	Not active (reserve)	0x400E:012 (P505.12)
12	Reverse rotational direction	0x400E:013 (P505.13)
13	Not active (reserve)	0x400E:014 (P505.14)
14	Not active (reserve)	0x400E:015 (P505.15)
15	Not active (reserve)	0x400E:016 (P505.16)

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 \(P591.01\)](#)
2. Frequency (0.01) [0x400C:006 \(P593.06\)](#)
3. Motor current [0x2D88 \(P104.00\)](#)

Status assignment of the NetWordOUT1 data word

Bit	Default setting	For details and configuration, see
0	Ready for operation	0x2634:010 (P420.10)
1	Not connected	0x2634:011 (P420.11)
2	Operation enabled	0x2634:012 (P420.12)
3	Fault active	0x2634:013 (P420.13)
4	Not connected	0x2634:014 (P420.14)
5	Quick stop active	0x2634:015 (P420.15)
6	Running	0x2634:016 (P420.16)
7	Device warning active	0x2634:017 (P420.17)
8	Not connected	0x2634:018 (P420.18)
9	Not connected	0x2634:019 (P420.19)
10	Setpoint speed reached	0x2634:020 (P420.20)
11	Current limit reached	0x2634:021 (P420.21)
12	Actual speed = 0	0x2634:022 (P420.22)
13	Rotational direction reversed	0x2634:023 (P420.23)
14	Release holding brake	0x2634:024 (P420.24)
15	Inverter disabled (safety)	0x2634:025 (P420.25)

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

Example for changing a pre-assigned mapping

The assignment of the third output word is to be changed. Due to the device description file, this output word (designation "16 bit selectable OUT-data_1") has already been assigned with the keypad setpoint.

The keypad setpoint is to be replaced by the acceleration ramp.

1. Mark the 3rd output word in the "Device view".
2. Select the "Module parameter" dialog in "Properties".
 - a) Display in "Index": 9729 (decimal form of the index 0x2601)
 - b) Display in "Subindex": 2
3. Replace the keypad setpoint in **0x2601:002 (P202.02)** with the acceleration ramp in **0x2917 (P220.00)**.
 - a) Check whether mapping is permitted for the current parameter to be mapped and the data type is complied with.
For this, see: [▶ Parameter attribute list](#)
 - b) Entry in "Index": 10519 (decimal form of the index 0x2917)
 - c) Entry in "Subindex": 0



The acceleration time must be defined later, e. g. at the FB LCB_ActuatorSpeed, input wFreeCtrl, with the factor 10 (10 s = 100).

3.15.4 Parameter data transfer

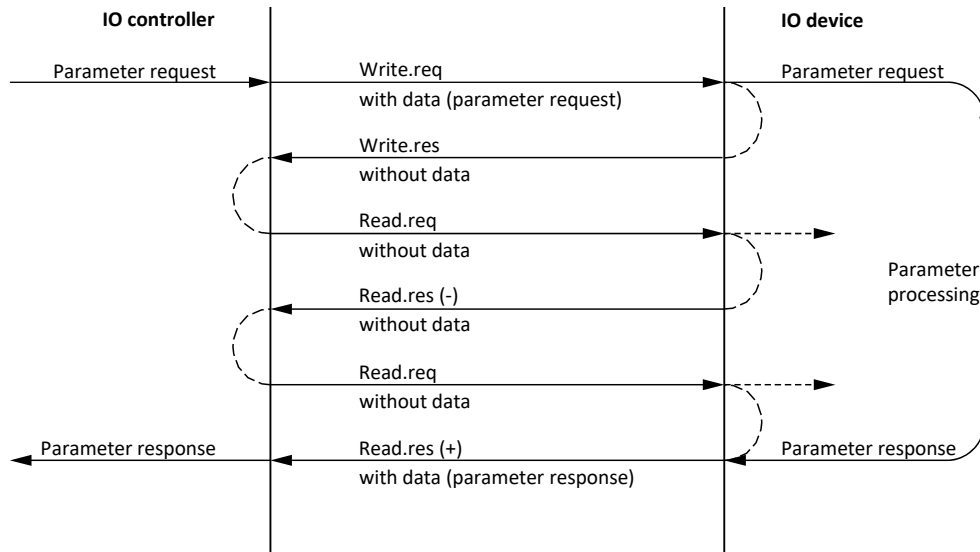
Data communication with PROFINET is characterised by the simultaneous operation of cyclic and acyclic services in the network. As an optional extension, the parameter data transfer belongs to the acyclic services, which provides access to all device parameters.

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	

3.15.5 Monitoring

The parameters for setting network monitoring functions are described below.

Parameter

Address	Name / setting range / [default setting]	Information
0x2859:001 (P515.01)	PROFINET monitoring: Watchdog elapsed (PROFINET monit.: WD elapsed)	Selection of the response to a permanent interruption of the communication to the IO controller. Corresponding error code: 33168 0x8190 "PROFINET: Watchdog time-out" Associated error code: • 33168 0x8190 - Network: watchdog timeout
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:002 (P515.02)	PROFINET monitoring: Data exchange exited (PROFINET monit.: Data exch.exited)	Selection of the response to exiting the "Data Exchange" state. Corresponding error code: 33171 0x8191 "PROFINET: Exit Data Exchange"
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:003 (P515.03)	PROFINET monitoring: Invalid configuration (PROFINET monit.: Invalid config)	Selection of the response triggered by the reception of invalid configuration data. Corresponding error code: 33414 0x8286 "PROFINET: Configuration error" Associated error code: • 33414 0x8286 - Network: PDO mapping error
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	
0x2859:004 (P515.04)	PROFINET monitoring: Initialisation error (PROFINET monit.: Init. error)	Selection of the response triggered by the occurrence of an error during the initialisation of the network component. Corresponding error code: 33170 0x8192 "PROFINET: Initialisation error" Associated error code: • 33170 0x8192 - Network: initialisation error
	0 No response	► Error types
	1 Warning	
	2 Trouble	
	3 Fault	



Address	Name / setting range / [default setting]	Information
0x2859:005 (P515.05)	PROFINET monitoring: Invalid process data (PROFINET monit.: Inval. proc.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 <ul style="list-style-type: none"> • a PLC in STOP state, • alarms, • acyclic demand data. Corresponding error code: 33171 0x8193 "PROFINET: Invalid cyclic process data" Associated error code: <ul style="list-style-type: none"> • 33171 0x8193 - Network: invalid cyclic process data
	0 No response	▶ Error types
	1 Warning	
	2 Trouble	
	3 Fault	




3.15.6 Diagnostics


3.15.6.1 LED status display


Notes on the connection status with IO-Controller can be obtained via the LEDs "BUS RDY" and "BUS ERR" of the PROFINET option (front of the device).

In addition, the LEDs "Link" and "Activity" at the RJ45 sockets indicate the connection status to the network.

"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
 Flickers	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)

"Link" LED (green)	Status/meaning
Off	No connection to the network.
 On	A physical connection to the network is available.

"Activity" LED (yellow)	Status/meaning
Off	No data transfer.
 On or flickers	Data is exchanged via the network.

3.15.6.2 Information on the network

The following parameters show information on the network.

Parameter

Address	Name / setting range / [default setting]	Information
0x2382:001 (P511.01)	Active PROFINET settings: IP address (PROFINET diag.: IP address) <ul style="list-style-type: none"> • Read only 	Display of the active IP address.

Address	Name / setting range / [default setting]	Information
0x2382:002 (P511.02)	Active PROFINET settings: Subnet (PROFINET diag.: Subnet) • Read only	Display of the active subnet mask.
0x2382:003 (P511.03)	Active PROFINET settings: Gateway (PROFINET diag.: Gateway) • Read only	Display of the gateway address.
0x2382:004 (P511.04)	Active PROFINET settings: Station name (PROFINET diag.: Station name) • Read only	Display of the active station name.
0x2382:005 (P511.05)	Active PROFINET settings: MAC Address (PROFINET diag.: MAC Address) • Read only	Display of the active MAC address.
0x2388 (P516.00)	PROFINET status (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 3 IP address error	The IP address is invalid. Valid IP addresses are defined according to RFC 3330.
	Bit 4 Hardware fault	
	Bit 6 Watchdog elapsed	PROFINET communication is continuously interrupted in the "Data_Exchange" state, e.g. by cable break or failure of the IO Controller. • 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 0x2859:001 (P515.01) is triggered in the inverter.
	Bit 7 Protocol error	
	Bit 8 PROFINET stack ok	
	Bit 9 PROFINET stack not configured	
	Bit 10 Ethernet controller fault	
	Bit 11 UDP stack fault	
0x2389:001 (P517.01)	PROFINET error: Error 1 (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 (P517.02) .
	0 No error	
	1 Reserved	
	2 Unit ID unknown	
	3 Max. units exceeded	
	4 Invalid size	
	5 Unit type unknown	
	6 Runtime plug error	
	7 Invalid argument	
	8 Service pending	
	9 Stack not ready	
	10 Command unknown	
	11 Invalid address descriptor	















Address	Name / setting range / [default setting]		Information
0x2389:002 (P517.02)	PROFINET error: Error 2 (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 (P517.01) .
	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 0x2859:001 (P515.01) is triggered in the device.
	Bit 10	Stack boot error	
	Bit 11	Stack online error	
	Bit 12	Stack state error	
	Bit 13	Stack revision error	
	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.
	Bit 15	Stack init error	

4. Diagnostics and fault elimination

This section contains information on error handling, drive diagnostics and fault analysis.

4.1 LED status display

The "RDY" and "ERR" LED status displays on the front of the inverter provide some quick information about certain operating states.

"RDY" LED (blue)	"ERR" LED (red)	Status/meaning
off	off	No supply voltage.
 on	 on	Initialisation (inverter is started.)
 blinking (1 Hz)	off	Safe torque off (STO) active. The inverter has been disabled by the integrated safety system. ▶ Safe torque off (STO)
	 blinking fast (4 Hz)	Safe torque off (STO) active, warning present. The inverter has been disabled by the integrated safety system.
 blinking (2 Hz)	off	Inverter inhibited.
	 blinking fast (4 Hz)	Inverter disabled, warning active. ▶ Error handling
	 on	Inverter disabled, error active. ▶ Error handling
	 lit every 1.5 s for a short time	Inverter inhibited, no DC-bus voltage.
	 on for a short time every 1 s	USB module is connected, 5-V supply voltage for the USB module is available.
 on	off	Inverter enabled. The motor rotates according to the specified setpoint or quick stop active.
	 blinking fast (4 Hz)	Inverter enabled, warning active. The motor rotates according to the specified setpoint or quick stop active.
	 blinking (1 Hz)	Inverter enabled, quick stop as response to fault active. ▶ Error handling
 Both LEDs are blinking in a rapidly alternating mode		Firmware update active. ▶ Update device firmware
 Both LEDs are blinking in a very rapidly synchronous mode		"Visual tracking" function is active. ▶ Optical device identification

4.2 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 (P700.15)	Device commands: Delete logbook (Device commands: Delete logbook) <ul style="list-style-type: none">• Setting can only be changed if the inverter is disabled.	<ul style="list-style-type: none">• 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	

4.3 Error history buffer

For purposes of diagnostics, the error history buffer contains the last 32 error and warning messages of the inverter, which have occurred during operation. The error history buffer can be read out using the keypad via P155.00 and provides a limited view on 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 P155.00 so that the new event becomes visible.

Accessing the error history buffer with the keypad

1. VEL:FLEX:AIN1
STOP
REM AUTO SET
2. Favorites
GROUP 0
REM AUTO SET
3. Diagnostics
GROUP 1
REM AUTO SET
4. Output frequency
P10000
REM AUTO SET
5. Error memory
P15500
REM AUTO SET
6. Warn. DC Bus UV
01 W 3221
REM AUTO SET
- Time: 01d17h04m00s
01 C 1001
REM AUTO SET

1. Use the **↩** key in the operating mode to navigate to the parameterisation mode one level below.

You are now in the group level. All parameters of the inverter are divided into different groups according to their function.

Note: By using the **↩** key you can navigate one level upwards again anytime.

2. Use the **↑** navigation key to select group 1 ("Diagnostics").

3. Use the **↩** key to navigate to one level below. You are now in the parameter level of the group selected.

4. Use the **↑** and **↓** select the P155.00 parameter.

5. Use the **↩** key to navigate to one level below. You are now in the error history buffer.

6. Use the **↑** and **↓** navigation keys you can now scroll through the error history buffer entries. Use the **↩** key, you can switch over the display.

Information displayed (page 1):

- ① Message text
- ② No. of the entry (01 = latest event)
- ③ Response (W = warning, T = trouble, F = fault)
- ④ Error code

Information displayed (page 2):

- ⑤ Time of occurrence
- ⑥ No. of the entry (01 = latest event)
- ⑦ Counter for successive, identical events

Note: By using the **↩** key you can exit the error history buffer again.

Parameter

Address	Name / setting range / [default setting]	Information
0x2006:000 (P155.00)	Error history buffer: Keypad display (Fault memory: Error memory) • Read only	Display of the error history buffer on the keypad.
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).

Address	Name / setting range / [default setting]	Information
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] ... 37	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: Buffer overflow 0 ... [1] ... 65535	Bit 0 ... bit 4 = 0. Bit 5 = 1 = overflow (after recording the 33rd event in the error history buffer).
	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	
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
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

Address	Name / setting range / [default setting]	Information
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:	00E010431201990000520B0473FC0100050001					
	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.

4.3.1 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 Info	
	1 Warning	
	2 Error	
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	
0x2007:007	Error history buffer: IO-Link message number • Read only	

4.4 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.
- The diagnostic parameters in group 1 are found on the keypad.

Parameter

Address	Name / setting range / [default setting]	Information
0x2030	CRC parameter set 0 ... [0] ... 4294967295	Display of the 32-bit hash sum for the integrity check of the parameter set.
0x2B0B	Frequency setpoint • 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 (P102.00)	Frequency setpoint (Freq. 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 (P100.00).
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 (P102.00). (Motor output frequency = output frequency of inverter - motor slip)
0x2D4F (P123.00)	Motor utilisation (i ² xt) (Mot. i ² t utilis.) • Read only: x %	Display of the current thermal motor utilisation.
0x2D87 (P105.00)	DC-bus voltage (DC-bus voltage) • Read only: x V	Display of the current DC-bus voltage.
0x2D88 (P104.00)	Motor current (Motor current) • Read only: x.x A	Display des present current-r.m.s. value.
0x2D89 (P106.00)	Motor voltage (Motor voltage) • Read only: x VAC	Display of the current motor voltage.
0x2DA2:001 (P108.01)	Output power: Effective power (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 (P108.02)	Output power: Apparent power (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 (P109.01)	Output energy: Motor (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 (P109.02)	Output energy: Generator (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 (I _{eff}) • Read only: x.xx A	Display of the effective motor current.
0x2DD3:003	Speed setpoint limited • Read only: x rpm	Display of the limited speed setpoint.

Address	Name / setting range / [default setting]	Information
0x2DDD (P100.00)	Output frequency (Inv. outp. freq.) • 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.
0x400D (P101.00)	Scaled actual value (Scaled act value) • Read only: x Units	Display of the current speed in application units.
0x6077 (P107.00)	Actual torque (Actual torque) • Read only: x.x %	Display of the actual torque. • 100 % = Rated motor torque 0x6076 (P325.00)
0x6078 (P103.00)	Actual current (Actual current) • Read only: x.x %	Display of the motor actual current. • 100 % = Rated motor current 0x6075 (P323.00)
0x6079	DC-bus voltage • Read only: x.xxx V	Display of the current DC-bus voltage.

4.4.1 Inverter diagnostics

The following parameters supply some information about the current operating status of the inverter.

This includes the following information:

- Active access protection after log-in by means of PIN1/PIN2
- Currently loaded parameter settings
- Cause(s) for disable, quick stop and stop
- Active control source and active setpoint source
- Active operating mode
- Status of the internal motor control
- Keypad status

Some of the following parameters contain bit-coded status words. Each single bit has a certain meaning.

► [Display of status words on keypad](#)







Parameter

Address	Name / setting range / [default setting]	Information
0x2040 (P197.00)	Access protection status (Protect. status) • Read only	Bit-coded display of the active access protection after login by PIN1/ PIN2.
	Bit 0 No write access	
	Bit 1 Only favorites changeable	
0x2827 (P198.00)	Currently loaded parameter settings (Status load. par) • Read only	Display of the parameter settings currently loaded. ► Behaviour of the inverter in case of incompatible data in the memory module ► Saving/loading the parameter settings
	0 User settings	User parameter settings of the memory module
	1 Reset 60 Hz setting	Delivery status (default setting) for 50-Hz device
	2 Reset 50 Hz setting	Delivery status (default setting) for 60-Hz device
	3 OEM default settings	OEM parameter settings of the memory module

Address	Name / setting range / [default setting]	Information
0x282A:001 (P126.01)	Status words: Cause of disable (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 (P400.01) .
	Bit 1 Network	1 = the inverter was disabled via network.
	Bit 2 Axis command	1 = the inverter was disabled via axis command .
	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	-
	Bit 12 CiA402 Inverter disabled	1 = the inverter was disabled by the internal state machine. The bit is only set if • Operating mode 0x6060 (P301.00) = "CiA: Velocity mode [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 (P301.00) .
0x282A:002 (P126.02)	Status words: Cause of quick stop (Status words: Cause of QSP) • 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 (P400.03) .
	Bit 1 Network	1 = quick stop was activated via network.
	Bit 2 Axis command	1 = quick stop was activated via axis command .
	Bit 6 Error response	1 = quick stop has been activated as a response to an error.
0x282A:003 (P126.03)	Status words: Cause of stop (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 (P400.02) .
	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 forward (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 6 Keypad	1 = stop was activated via keypad.
	Bit 7 Control mode transition	1 = stop has been activated due to a change of the operating mode.
	Bit 8 End of sequence	1 = stop was activated by the "sequencer" function since the sequence is completed. • The bit is only set after the sequence is completed if End of sequence mode 0x402F (P824.00) is set = "Stop [1]" or "Stop and abort [2]".
	Bit 9 Manual mode	-
	Bit 15 Waiting for start	1 = stop is active as a start command is not yet available (e. g. after enabling the inverter).

Address	Name / setting range / [default setting]	Information
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 inverter has been disabled by the integrated safety system.
	Bit 11 STO active	1 = "Safe torque off (STO)" function has been triggered by the integrated safety system. Safe inputs SIA and SIB = LOW (simultaneously).
0x282A:005 (P126.05)	Status words: Device status (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 (P125.01)	Inverter diagnostics: Active control source (Inverter diag.: Active control) • Read only	Display of the control source that is currently active.
	0 Flexible I/O configuration	
	1 Network	
	2 Keypad	
	8 Keypad full control	
	9 Manual mode	
0x282B:002 (P125.02)	Inverter diagnostics: Active setpoint source (Inverter diag.: Active setpoint) • Read only	Display of the setpoint source that is currently active.
	0 Not selected	
	1 Analog input 1	
	2 Analog input 2	
	3 Keypad Setpoint	
	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	
	31 Segment preset 1	
	32 Segment preset 2	
	33 Segment preset 3	

Address	Name / setting range / [default setting]		Information
	34	Segment preset 4	
	35	Segment preset 5	
	36	Segment preset 6	
	37	Segment preset 7	
	38	Segment preset 8	
	39	Last segment	
	50	Motor potentiometer	
	51	PID setpoint	
	201	Internal value	Internal values of the manufacturer.
	202	Internal value	
	203	Internal value	
	204	Internal value	
	205	Internal value	
	206	Internal value	
0x282B:003 (P125.03)	Inverter diagnostics: Keypad LCD status (Inverter diag.: Keypad LCD stat.) • Read only		Bit-coded state of the keypad status displays.
	Bit 0	LOC	1 = local keypad control active.
	Bit 1	REM	1 = remote control via terminals, network, etc. active.
	Bit 2	MAN	1 = manual setpoint selection via keypad active.
	Bit 3	Auto	1 = automatic setpoint selection via terminals, network, etc. active.
	Bit 4	Set	1 = a parameter setting has been changed but not been saved yet in the memory module with mains failure protection .
0x282B:004 (P125.04)	Inverter diagnostics: Active drive mode (Inverter diag.: 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.
	4	Jog operation	"Jog forward (CW)" or "Jog reverse (CCW)" function active.
0x2831	Inverter-Statuswort • 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	Soll-Q-Strom limitiert	1 = setpoint current in limitation.
	Bit 5	Speed setpoint 2 limited	1 = input of speed controller 2 in "torque mode" in limitation.
	Bit 6	Obere Drehzahlgrenze aktiv	1 = in "torque mode", the speed is limited to upper speed limit 0x2946:001 (P340.01) .
	Bit 7	Untere Drehzahlgrenze aktiv	1 = in "torque mode", the speed is limited to lower speed limit 0x2946:002 (P340.02) .
	Bit 8	Flying restart active	-
	Bit 10	Output frequency limited	1 = setpoint frequency with V/f operation in limitation.
	Bit 11	Magnetisation completed	1 = during V/f operation, the factor 7 rotor time constant has passed (calculated from the time at which the inverter was enabled without restart on the fly and with a total motor current of 20 % rated motor current for the first time). Otherwise 0.
	Bit 12	Motorphasenfehler	1 = motor phase failure detection active.
	Bit 14	Error reset blocking time active	1 = the error can only be reset when the blocking time has elapsed.
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.
	Bit 15	UPS operation active	1 = UPS operation active.

Address	Name / setting range / [default setting]	Information
0x293A (P116.00)	Actual switching frequency (Actual sw. freq.) • 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 (P305.00) . • 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	
0x2DAC (P119.00)	Keypad status (Keypad status) • Read only	Bit-coded display of the keypad status.
	Bit 0 Start Key	1 = keypad start key  pressed.
	Bit 1 Stop Key	1 = keypad stop key  pressed.
	Bit 2 Up arrow	1 = keypad up-arrow key  pressed.
	Bit 3 Down arrow	1 = keypad down-arrow key  pressed.
	Bit 4 Enter Key	1 = keypad enter key  pressed.
	Bit 5 Back key	1 = keypad back key  pressed.
0x2DAD (P120.00)	Internal hardware states (Int. HW states) • Read only	Bit-coded display of internal hardware states.
	Bit 0 Relay	0 = X9/NO-COM open and NC-COM closed. 1 = X9/NO-COM closed and NC-COM open.
	Bit 1 Digital output 1	0 = LOW level, 1 = HIGH level.
	Bit 2 Digital output 2	
	Bit 10 Charge Relay	1 = precharging of the DC bus via charge relay is active.
0x603F (P150.00)	Error code (Error code) • Read only	Error message

4.4.2 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
0x282B:005 (P125.05)	Inverter diagnostics: Most recently used control register (Inverter diag.: Netw. contr.reg.) • Read only	Display of the network register for the control that was accessed last (e. g. 0x6040 or 0x400B:1). • Format: 0xiiii:ss00 (iiii = hexadecimal index, ss = hexadecimal subindex) • The lowest byte is always 0x00.
0x282B:006 (P125.06)	Inverter diagnostics: Most recently used setpoint register (Inverter diag.: Netw. setp.reg.) • Read only	Display of the network register for setpoint selection that was accessed last (e. g. 0x6042 or 0x400B:3). • Format: 0xiiii:ss00 (iiii = hexadecimal index, ss = hexadecimal subindex) • The lowest byte is always 0x00.

Address	Name / setting range / [default setting]	Information
0x231F:001 (P500.01)	Communication module ID: Active module ID (Module ID: Active module ID) • Read only	Display of the network options currently configured in the device. • With the help of this module ID, the keypad only shows the communication parameters relevant to the respective network. 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").
	48 No network	
	67 CANopen	
	71 EtherNet/IP	
	72 BACnet	
	78 POWERLINK	
	80 PROFIBUS	
	82 PROFINET	
	84 EtherCAT	
	86 Modbus TCP/IP	
	87 Modbus RTU	
0x231F:002 (P500.02)	Communication module ID: Module ID connected (Module ID: Module ID conn.) • Read only	Display of the network options currently available 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").
	48 No network	
	67 CANopen	
	71 EtherNet/IP	
	72 BACnet	
	78 POWERLINK	
	80 PROFIBUS	
	82 PROFINET	
	84 EtherCAT	
	86 Modbus TCP/IP	
	87 Modbus RTU	

Related topics

- [Configuring the network](#)

4.4.3 I/O diagnostics

This section describes the diagnostics of the analog and digital inputs and outputs that can be found on the control terminal X3.

4.4.3.1 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 (P118.00)	Digital input status (Digital inputs) • Read only	Bit coded display of the current status of the digital inputs
	Bit 16 Digital input 1	0 = LOW level, 1 = HIGH level.
	Bit 17 Digital input 2	Digital input 6 and digital input 7 are only available with application I/O.
	Bit 18 Digital input 3	
	Bit 19 Digital input 4	
	Bit 20 Level from digital input 5	
	Bit 21 Level from digital input 6	
	Bit 22 Level from digital input 7	
0x2DAD (P120.00)	Internal hardware states (Int. HW states) • Read only	Bit-coded display of internal hardware states.
	Bit 0 Relay	0 = X9/NO-COM open and NC-COM closed. 1 = X9/NO-COM closed and NC-COM open.
	Bit 1 Digital output 1	0 = LOW level, 1 = HIGH level.
	Bit 2 Digital output 2	
	Bit 10 Charge Relay	1 = precharging of the DC bus via charge relay is active.
0x4016:005	Digital output 1: Terminal state • Read only	Display of the logic state of output terminal X3/DO1.
	0 FALSE	
	1 TRUE	
0x4016:006	Digital output 1: Trigger signal state • Read only	Display of the logic state of the trigger signal for digital output 1 (without taking a ON/OFF delay set and inversion into consideration).
	0 FALSE	
	1 TRUE	
0x4017:005	Digital output 2: Terminal state • Read only • Only available for application I/O.	Display of the logic state of output terminal X3/DO2.
	0 FALSE	
	1 TRUE	
0x4017:006	Digital output 2: Trigger signal state • Read only • Only available for application I/O.	Display of the logic state of the trigger signal for digital output 2 (without taking a ON/OFF delay set and inversion into consideration).
	0 FALSE	
	1 TRUE	
0x4018:005	Relay: Relay state • Read only	Display of the logic state of the relay.
	0 FALSE	
	1 TRUE	

Address	Name / setting range / [default setting]	Information
0x4018:006	Relay: Trigger signal state	Display of the logic state of the trigger signal for the relay (without taking a ON/OFF delay set and inversion into consideration).
	• Read only	
	0 FALSE	
	1 TRUE	

Related topics

► [Configure digital inputs](#)

► [Configure digital outputs](#)

4.4.3.2 Analog inputs and outputs

The following parameters serve to diagnose the analog inputs and outputs of the inverter.

Parameter

Address	Name / setting range / [default setting]	Information
0x2DA4:001 (P110.01)	Diagnostics of analog input 1: Value in percent (AI1 diagnostics: AI1 terminal %) • Read only: x.x %	Display of the current input value at X3/AI1 scaled as value in percent. • 100 % = 10 V or 20 mA or 5 V
0x2DA4:002 (P110.02)	Diagnostics of analog input 1: Frequency value (AI1 diagnostics: AI1 scaled freq.) • Read only: x.x Hz	Display of the current input value at X3/AI1 scaled as a frequency value. • The standard setpoint source for operating mode 0x6060 (P301.00) = "MS: Velocity mode [-2]" is selected in 0x2860:001 (P201.01) .
0x2DA4:003 (P110.03)	Diagnostics of analog input 1: Process controller value (AI1 diagnostics: AI1 scaled PID) • Read only: x.xx PID unit	Display of the current input value at X3/AI1 scaled as a process controller value. • The standard setpoint source for the reference value of PID control is selected in 0x2860:002 (P201.02) .
0x2DA4:004 (P110.04)	Diagnostics of analog input 1: Torque value (AI1 diagnostics: AI1 scaled torq.) • Read only: x.x %	Display of the current input value at X3/AI1 scaled as a percentage torque value. • 100 % = permissible maximum torque 0x6072 (P326.00) • The standard setpoint source for operating mode 0x6060 (P301.00) = "MS: Torque mode [-1]" is selected in 0x2860:003 (P201.03) .
0x2DA4:016 (P110.16)	Diagnostics of analog input 1: Status (AI1 diagnostics: AI1 status) • Read only	Bit coded display of the status of analog input 1 (X3/AI1).
	Bit 0 Mode 0: 0 ... 10 VDC active	
	Bit 1 Mode 1: 0 ... 5 VDC active	
	Bit 2 Mode 2: 2 ... 10 VDC active	
	Bit 3 Mode 3: -10 ... 10 VDC active	
	Bit 4 Mode 4: 4 ... 20 mA active	
	Bit 5 Mode 5: 0 ... 20 mA active	
	Bit 6 24 V supply OK	
	Bit 7 Calibration successful	
	Bit 8 Monitoring threshold exceeded/not reached	
	Bit 9 Input current too low (mode 4)	
	Bit 10 Input voltage too low (mode 2)	
	Bit 11 Input voltage too high (mode 4)	
0x2DA5:001 (P111.01)	Diagnostics of analog input 2: Value in percent (AI2 diagnostics: AI2 terminal %) • Read only: x.x %	Display of the current input value at X3/AI2 scaled as a value in percent. • 100 % = 10 V or 20 mA or 5 V
0x2DA5:002 (P111.02)	Diagnostics of analog input 2: Frequency value (AI2 diagnostics: AI2 scaled freq.) • Read only: x.x Hz	Display of the current input value at X3/AI2 scaled as a frequency value. • The standard setpoint source for operating mode 0x6060 (P301.00) = "MS: Velocity mode [-2]" is selected in 0x2860:001 (P201.01) .
0x2DA5:003 (P111.03)	Diagnostics of analog input 2: Process controller value (AI2 diagnostics: AI2 scaled PID) • Read only: x.xx PID unit	Display of the current input value at X3/AI2 scaled as a process controller value. • The standard setpoint source for the reference value of PID control is selected in 0x2860:002 (P201.02) .
0x2DA5:004 (P111.04)	Diagnostics of analog input 2: Torque value (AI2 diagnostics: AI2 scaled torq.) • Read only: x.x %	Display of the current input value at X3/AI2 scaled as a percentage torque value. • 100 % = permissible maximum torque 0x6072 (P326.00)

Address	Name / setting range / [default setting]	Information
0x2DA5:016 (P111.16)	Diagnostics of analog input 2: Status (AI2 diagnostics: AI2 status) • Read only	Bit-coded display of the status of analog input 2 (X3/AI2).
	Bit 0 Mode 0: 0 ... 10 VDC active	
	Bit 1 Mode 1: 0 ... 5 VDC active	
	Bit 2 Mode 2: 2 ... 10 VDC active	
	Bit 3 Mode 3: -10 ... 10 VDC active	
	Bit 4 Mode 4: 4 ... 20 mA active	
	Bit 5 Mode 5: 0 ... 20 mA active	
	Bit 6 24 V supply OK	
	Bit 7 Calibration successful	
	Bit 8 Monitoring threshold exceeded/not reached	
	Bit 9 Input current too low	
	Bit 10 Input voltage too low	
	Bit 11 Input voltage too high	
0x2DAA:001 (P112.01)	Diagnostics of analog output 1: Voltage (AO1 diagnostics: AO1 Voltage) • Read only: x.xx V	Display of the current output voltage at X3/AO1.
0x2DAA:002 (P112.02)	Diagnostics of analog output 1: Current (AO1 diagnostics: AO1 Current) • Read only: x.xx mA	Display of the present output current at X3/AO1.
0x2DAB:002 (P113.02)	Diagnostics of analog output 2: Current (AO2 diagnostics: AO2 Voltage) • Read only: x.xx mA • Only available for application I/O.	Display of the present output current at X3/AO2.
0x2DAB:001 (P113.01)	Diagnostics of analog output 2: Voltage (AO2 diagnostics: AO2 Current) • Read only: x.xx V • Only available for application I/O.	Display of the current output voltage at X3/AO2.

Related topics

► [Configure analog inputs](#)

► [Configure analog outputs](#)

4.4.4 Service life diagnostics

The following parameters provide some information about the use of the inverter.

This includes the following information:

- Operating and power-on time of the inverter/control unit
- Operating time of the internal fan
- Number of switching cycles of the mains voltage
- Number of switching cycles of the relay
- Number of short-circuits and earth faults that have occurred
- Display of the number of "Clamp responded too often" errors that have occurred.

Parameter

Address	Name / setting range / [default setting]	Information
0x2D81:001 (P151.01)	Life-diagnosis: Operating time (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 (P151.02)	Life-diagnosis: Power-on time (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 (P151.03)	Life-diagnosis: Control unit operating time (Life-diagnosis: CU oper. 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 (P151.04)	Life-diagnosis: Main switching cycles (Life-diagnosis: Switching cycles) • Read only	Display of the number of switching cycles of the mains voltage.

Address	Name / setting range / [default setting]	Information
0x2D81:005 (P151.05)	Life-diagnosis: Relay switching cycles (Life-diagnosis: Relay cycles) • Read only	Display of the number of switching cycles of the relay.
0x2D81:006 (P151.06)	Life-diagnosis: Short-circuit counter (Life-diagnosis: Short-circ.count) • Read only	Display of the number of short circuits that have occurred.
0x2D81:007 (P151.07)	Life-diagnosis: Earth fault counter (Life-diagnosis: Earthfault count) • Read only	Display of the number of earth faults that have occurred.
0x2D81:008 (P151.08)	Life-diagnosis: Clamp active (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 (P151.09)	Life-diagnosis: Fan operating time (Life-diagnosis: Fan oper. time) • Read only: x s	Display showing for how long the internal fan has been running so far.

4.4.5 Device identification

The following parameters show some general information about the inverter.

Parameter

Address	Name / setting range / [default setting]	Information
0x2000:001 (P190.01)	Device data: Product code (Device data: Product code) • Read only	Product code of the complete device. Example: "I55AE155D10V10017S" • If control unit and power unit were ordered separately, the product code "XXXXXXXXXXXXXXXXXX" is displayed.
0x2000:002 (P190.02)	Device data: Serial number (Device data: Serial number) • Read only	Serial number of the complete device. Example: "0000000000000000XYZXYZ" • If control unit and power unit were ordered separately, the serial number "XXXXXXXXXXXXXXXXXX" is displayed.
0x2000:004 (P190.04)	Device data: CU firmware version (Device data: CU firmware ver.) • Read only	Firmware version of the control unit. Example: "01.00.01.00"
0x2000:005 (P190.05)	Device data: CU firmware type (Device data: CU firmware type) • Read only	Firmware type of the control unit. Example: "IOFW51AC10"
0x2000:006 (P190.06)	Device data: CU bootloader version (Device data: CU bootlader ver.) • Read only	Bootloader version of the control unit. Example: "2015.10-20180517"
0x2000:007 (P190.07)	Device data: CU bootloader type (Device data: CU bootlader type) • Read only	Bootloader type of the control unit. Example: "IOBL51AOnn"
0x2000:008 (P190.08)	Device data: Object directory version (Device data: OBD version) • Read only	Example: "108478"
0x2000:010 (P190.10)	Device data: PU firmware version (Device data: PU firmware ver.) • Read only	Firmware version of the power unit. Example: "00202"
0x2000:011 (P190.11)	Device data: PU firmware type (Device data: PU firmware type) • Read only	Firmware type of the power unit. Example: "IDFW5AA"
0x2000:012 (P190.12)	Device data: PU bootloader version (Device data: PU bootlader ver.) • Read only	Bootloader version of the power unit.
0x2000:013 (P190.13)	Device data: PU bootloader type (Device data: PU bootlader type) • Read only	Bootloader type of the power unit.
0x2000:014 (P190.14)	Device data: Module - firmware version (Device data: Mod. firmware) • Read only	Firmware version of the plugged-in module (e.g. WLAN module).

Address	Name / setting range / [default setting]	Information
0x2000:015 (P190.15)	Device data: Communication firmware revision number (Device data: Com. FW rev no.) • Read only	Firmware version of the network option.
0x2000:016 (P190.16)	Device data: Communication bootloader revision number (Device data: ComBootlderRevNo) • Read only	Bootloader version of the network option.
0x2000:017 (P190.17)	Device data: CU firmware subtype (Device data: CU FW subtype) • Read only	Additional information on the firmware.
0x2002:004 (P192.04)	Device module: CU type code (Device module: CU type code) • Read only	Type code of the control unit
0x2002:005 (P192.05)	Device module: PU type code (Device module: PU type code) • Read only	Type code of the power unit.
0x2002:006 (P192.06)	Device module: CU serial number (Device module: CU serial number) • Read only	Serial number of the control unit.
0x2002:007 (P192.07)	Device module: PU serial number (Device module: PU serial number) • Read only	Serial number of the power unit.

4.5 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.

4.5.1 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 "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](#)
- **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](#)".
- The restart behaviour after trouble can be configured. ▶ [Automatic restart after a fault](#)



In the operating mode [0x6060 \(P301.00\)](#) = "CiA: Velocity mode [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 in the CiA status word 0x6041 (P780.00)	Inverter disable	Motor stop	Error reset is required	"ERR" LED (red)
No response	No	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)
Fault	Yes	yes, bit 3	For details see table " Error codes, causes and remedies ".		Yes	 on

Timeout for error response

If an error occurs that does not immediately cause a switch-off, the "Fault reaction active" device status initially becomes active. The motor is brought to a standstill with quick stop ramp. The change to the device status "Fault" is only made after the quick stop (motor at standstill) has been executed or after an adjustable timeout time has expired.

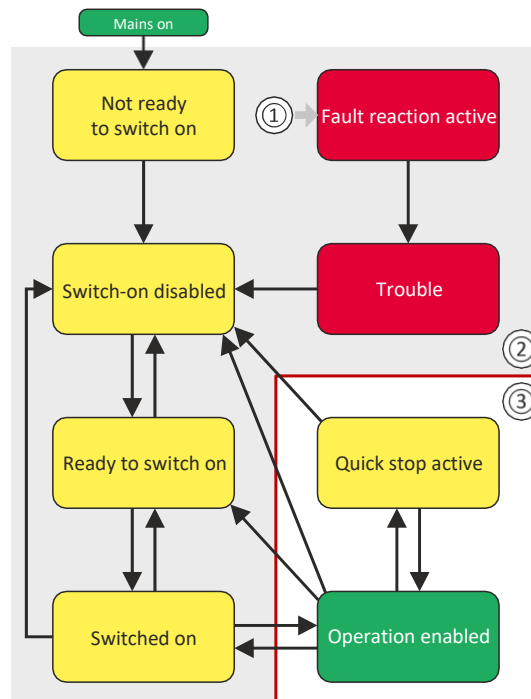


Disabling the inverter interrupts the quick stop ramp. The drive coasts immediately.

Details

In the device status "Fault reaction active"

- only the parameters of the inverter can be changed that do not require an inverter disable.
- If a holding brake in brake mode [0x2820:001 \(P712.01\)](#) = "Automatically (via device state) [0]" is triggered for closing,
- the motor control continues to be operable.



- ① From all states
- ② Power section disabled (pulse inhibit)
- ③ Power section enabled

Diagnostic parameters:

- [0x282A:005 \(P126.05\)](#) displays the current device status of the inverter

Parameter

Address	Name / setting range / [default setting]	Information
0x2826	Time-out for error response 0.0 ... [6.0] ... 100.0 s	<p>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.</p> <ul style="list-style-type: none"> In case of a serious error, an immediate change-over to the "Fault" device status takes place. <p>CAUTION!</p> <p>Changing this parameter may cause a longer ramp time in the event of an error. This must be considered when changing this parameter.</p>

Related topics

- [Automatic restart after a fault](#)

4.5.2 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.

4.5.3 Error reset

If the error condition is not active anymore, there are several options to reset an active error and thus leave the error state again:

- Via the keypad key . ▶ [Error reset with keypad](#)
- Via the trigger assigned to the "Reset fault" function.
- Via the button  in the »Remote Sinus« ("Diagnostics" tab).
- In the default setting of [0x400E:008 \(P505.08\)](#) via bit 7 in the mappable data word NetWordIN1 [0x4008:001 \(P590.01\)](#).
- Via bit 7 in the mappable CiA control word [0x6040](#).
- Via bit 2 in the mappable AC Drive control word [0x400B:001 \(P592.01\)](#).

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.

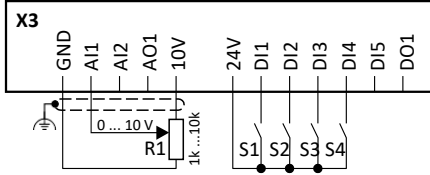
Parameter

Address	Name / setting range / [default setting]	Information
0x2631:004 (P400.04)	Function list: Reset fault (Function list: Reset fault) <ul style="list-style-type: none">• Further possible settings: ▶ Trigger list	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 (P411.02) into consideration.

Address	Name / setting range / [default setting]	Information
0x2839:006 (P760.06)	Fault configuration: Fault handling in case of state change (Fault config.: FaultStateChange)	Selection whether a pending error is to be reset via the functions "Enable inverter" 0x2631:001 (P400.01) and "Run" 0x2631:002 (P400.02) as well.
	0 Reset fault	
	1 Do not reset fault	

Example for operating mode

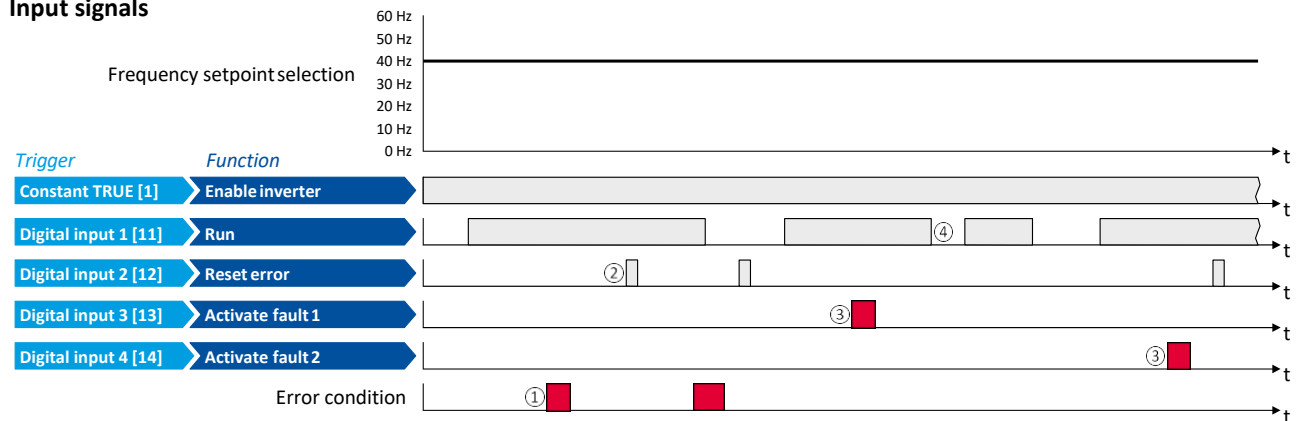
- Switch S1 starts the motor in forward direction of rotation. De-asserting switch S1 stops the motor again.
- Switch S2 resets the current error if the error condition is not active anymore and the error is resettable.
- The switches/sensors S3 and S4 serve to set the inverter from the process to the error status. ▶ [User-defined error triggering](#)

Connection plan	Function	
	Potentiometer R1	Frequency setpoint selection
	Switch S1	Run
	Switch S2	Reset fault
	Switch S3	Activate fault 1
	Switch S4	Activate fault 2

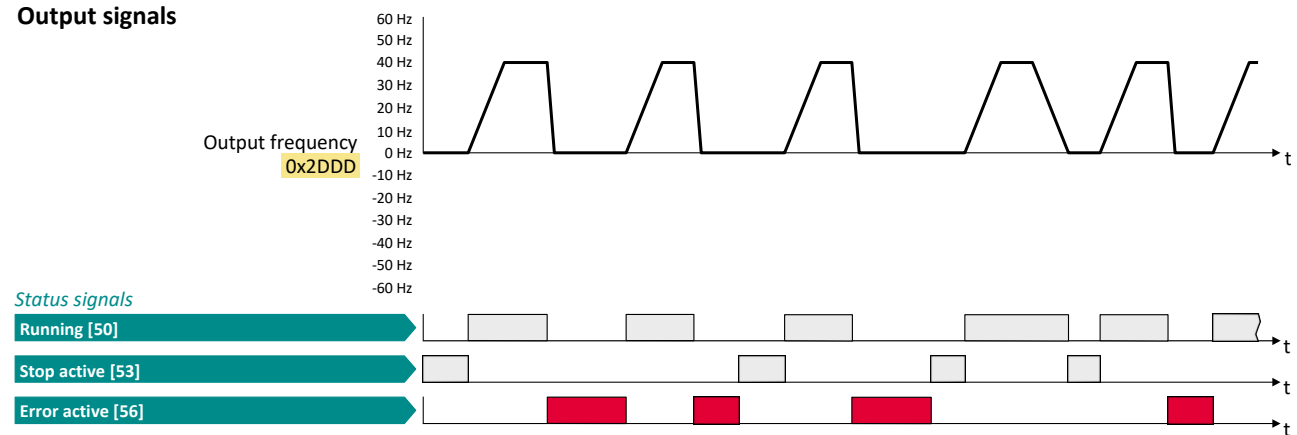
Parameter	Designation	Setting for this example
0x2631:001 (P400.01)	Enable inverter	Constant TRUE [1]
0x2631:002 (P400.02)	Run	Digital input 1 [11]
0x2631:004 (P400.04)	Reset fault	Digital input 2 [12]
0x2631:013 (P400.13)	Reverse rotational direction	Not connected [0]
0x2631:018 (P400.18)	Activate preset (bit 0)	Not connected [0]
0x2631:043 (P400.43)	Activate fault 1	Digital input 3 [13]
0x2631:044 (P400.44)	Activate fault 2	Digital input 4 [14]
0x2824 (P200.00)	Control selection	Flexible I/O configuration [0]
0x2838:003 (P203.03)	Stop method	Standard ramp [1]
0x2860:001 (P201.01)	Frequency control: Default setpoint source	Analog input 1 [2]
0x2918 (P221.00)	Deceleration time 1	5.0 s
0x291C (P225.00)	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:

Input signals



Output signals



The status signals can be assigned to digital outputs. ▶ [Configure digital outputs](#)

- 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 state 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 leaving the error state (if the error condition no longer exists).

4.6 Error codes, causes and remedies

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 (P308.03)
9090	0x2382 Fault - Device utilization (ixt) too high	Fault	0x2D40:005 (P135.05)
9091	0x2383 Warning - Device utilization (ixt) too high	Warning	-
9095	0x2387 Clamp responded too often	Fault	-
9096	0x2388 SL-PSM stall detection active	Trouble	-
9098	0x238A Maximum current reached	Information	-
12576	0x3120 Mains phase fault	Fault	-
12672	0x3180 UPS operation active	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 too 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 (P309.02)
20754	0x5112 24 V supply critical	Warning	-
20864	0x5180 Overload 24 V supply	Warning	-
21376	0x5380 OEM hardware incompatible	Fault	-
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 Maximum allowed troubles exceeded	Fault	-
25248	0x62A0 User-defined fault (LECOM)	Fault	-
25249	0x62A1 Network: user fault 1	Fault	-
25250	0x62A2 Network: user fault 2	Fault	-
25265	0x62B1 NetWordIN1 configuration incorrect	Trouble	-
25266	0x62B2 Device ID has been changed	Fault	-
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	-
28801	0x7081 Fault - Analog input 1	Fault	0x2636:010 (P430.10)
28802	0x7082 Analog input 2 fault	Fault	0x2637:010 (P431.10)
28803	0x7083 HTL input fault	No response	0x2641:006 (P416.06)
28833	0x70A1 Analog output 1 fault	Warning	-
28834	0x70A2 Analog output 2 fault	Warning	-
28961	0x7121 Fault - Pole position identification	Fault	0x2C60
29056	0x7180 Motor overcurrent	Fault	0x2D46:002 (P353.02)
29445	0x7305 Encoder open circuit	Warning	0x2C45 (P342.00)
29573	0x7385 Feedback system: speed limit	Warning	-
30336	0x7680 Memory module is full	Warning	-

Error code	Error message	Error type	Configurable in
30337	0x7681 Memory module not present	Fault	-
30338	0x7682 Memory module: Invalid user data	Fault	-
30340	0x7684 Data not compl. saved before powerdown	Warning	-
30345	0x7689 Memory module: invalid OEM data	Warning	-
30346	0x768A Memory module: wrong type	Fault	-
30352	0x7690 EPM firmware version incompatible	Fault	-
30353	0x7691 EPM data: firmware type incompatible	Fault	-
30354	0x7692 EPM data: new firmware type detected	Fault	-
30355	0x7693 EPM data: PU size incompatible	Fault	-
30356	0x7694 EPM data: new PU size detected	Fault	-
30357	0x7695 Invalid parameter changeover configuration	Warning	-
30358	0x7696 EPM data: unknown parameter found	Information	-
30359	0x7697 Parameter changes lost	Fault	-
33042	0x8112 Network: timeout explicit message	Warning	0x2859:006 (P515.06)
33044	0x8114 Network: overall communication timeout	Warning	See details for 33044
33045	0x8115 Time-out (PAM)	No response	0x2552:004 (P595.04)
33046	0x8116 Modbus TCP master time-out	Fault	0x2859:008 (P515.08)
33047	0x8117 Modbus TCP Keep Alive time-out	Fault	0x2859:009 (P515.09)
33154	0x8182 CAN: bus off	Trouble	0x2857:010
33155	0x8183 CAN: warning	Warning	0x2857:011
33156	0x8184 CAN: heartbeat time-out consumer 1	Fault	0x2857:005
33157	0x8185 CAN: heartbeat time-out consumer 2	Fault	0x2857:006
33158	0x8186 CAN: heartbeat time-out consumer 3	Fault	0x2857:007
33159	0x8187 CAN: heartbeat time-out consumer 4	Fault	0x2857:008
33168	0x8190 Network: watchdog timeout	Trouble	See details for 33168
33169	0x8191 Network: disruption of cyclic data exchange	No response	0x2859:002 (P515.02)
33170	0x8192 Network: initialisation error	Trouble	See details for 33170
33171	0x8193 Network: invalid cyclic process data	Trouble	See details for 33171
33185	0x81A1 Modbus: network time-out	Fault	0x2858:001 (P515.01)
33186	0x81A2 Modbus: incorrect request by master	Warning	-
33200	0x81B0 Network communication faulty	Trouble	-
33381	0x8265 POWERLINK: Loss of SoC	Trouble	0x2859:011
33382	0x8266 POWERLINK: CRC error	Trouble	0x2859:010
33414	0x8286 Network: PDO mapping error	Trouble	See details for 33414
33425	0x8291 CAN: RPDO1 time-out	Fault	0x2857:001
33426	0x8292 CAN: RPDO2 time-out	Fault	0x2857:002
33427	0x8293 CAN: RPDO3 time-out	Fault	0x2857:003
33553	0x8311 Torque limit reached	No response	0x2D67:001 (P329.01)
33664	0x8380 Function not allowed in selected operating mode	Warning	-
36992	0x9080 Keypad removed	Fault	-
65282	0xFF02 Fault - Brake resistor overload	Fault	0x2550:011 (P707.11)
65285	0xFF05 Safety option - Internal error	Fault	-
65286	0xFF06 Motor overspeed	Fault	0x2D44:002 (P350.02)
65289	0xFF09 Motor phase missing	No response	0x2D45:001 (P310.01)
65290	0xFF0A Motor phase failure phase U	No response	0x2D45:001 (P310.01)
65291	0xFF0B Motor phase failure phase V	No response	0x2D45:001 (P310.01)
65292	0xFF0C Motor phase failure phase W	No response	0x2D45:001 (P310.01)
65305	0xFF19 Motor parameter identification fault	Fault	-
65311	0xFF1F FMF Error	Fault	-
65317	0xFF25 Cascading overload	Warning	-
65334	0xFF36 Warning - Brake resistor overload	Warning	0x2550:010 (P707.10)
65335	0xFF37 Automatic start disabled	Fault	-
65336	0xFF38 Load loss detected	No response	0x4006:003 (P710.03)
65337	0xFF39 Motor overload	No response	0x4007:003
65366	0xFF56 Maximum motor frequency reached	Warning	-

Error code	Error message	Error type	Configurable in
65370	0xFF5A Manual mode deactivated	Warning	-
65371	0xFF5B Manual mode activated	Warning	-
65372	0xFF5C Manual mode time-out	Fault	-
65393	0xFF71 Wrong password	Warning	-
65394	0xFF72 Warning	Warning	-
65395	0xFF73 Fatal Error	Fault	-
65396	0xFF74 Power unit fatal error	Fault	-
65413	0xFF85 Keypad full control active	Warning	-

8784 | 0x2250 **CiA: Continuous over current (internal)**

Keypad display: **PU over current**

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> Continuous overcurrent on the inverter/motor side. Overcurrent at the brake chopper (brake transistor). DC bus relay has not been closed due to a malfunction. 	<ul style="list-style-type: none"> Check motor and wiring for short circuits. Check brake resistor and wiring. Check motor switching. Check settings of the motor data. 	Fault <ul style="list-style-type: none"> 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**

Keypad display: **Earth leak**

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> Short circuit/earth fault of motor cable Capacitive charging current of the motor cable too high. 	<ul style="list-style-type: none"> Check motor cable. Check length of the motor cable. Use shorter or lower-capacitance motor cable. 	Fault <ul style="list-style-type: none"> 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**

Keypad display: **Motor shorted**

Cause	Remedy	Error type/response
Short circuit of motor cable	Check motor cable for short circuit.	Fault <ul style="list-style-type: none"> 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: i²t overload (thermal state)**

Keypad display: **i2t motor**

Cause	Remedy	Error type/response
Motor thermally overloaded, e. g. by an impermissible continuous current or by frequent or too long acceleration processes.	<ul style="list-style-type: none"> Check drive sizing. Check machine/driven mechanics for excessive load. Check settings of the motor data. Reduce values for slip compensation 0x2B09:001 (P315.01), 0x2B09:002 (P315.02) and oscillation damping 0x2B0A:001 (P318.01), 0x2B0A:002 (P318.02). 	Fault (configurable) <ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 5 s
		Setting parameters: 0x2D4B:003 (P308.03)

Related topics

► [Motor overload monitoring \(i²t\)](#)

9090 | 0x2382 **Fault - Device utilization (ixt) too high**

Keypad display: **Ixt error**

Cause	Remedy	Error type/response
Device utilisation (I*t) too high by frequent and too long acceleration processes.	<ul style="list-style-type: none"> Check drive sizing. Reduce the maximum current of the inverter 0x6073 (P324.00). In case of high mass inertias, reduce maximum current of the inverter 0x6073 (P324.00) to 150 %. 	Fault (configurable)
		<ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 3 s
		Setting parameters: 0x2D40:005 (P135.05)

Related topics

► [Device overload monitoring \(ixt\)](#)

9091 | 0x2383 **Warning - Device utilization (ixt) too high**

Keypad display: **Ixt warning**

Cause	Remedy	Error type/response
Device utilisation (I*t) too high by frequent and too long acceleration processes.	Check drive dimensioning.	Warning

Related topics

► [Device overload monitoring \(ixt\)](#)

9095 | 0x2387 **Clamp responded too often**

Keypad display: **Clamp timeout**

Cause	Remedy	Error type/response
Maximum current of the axis (display in 0x2DDF:002) has been reached too often in succession.	<ul style="list-style-type: none"> Select a flatter speed ramp. Reduce the load. Set I_{max} controller more dynamically. 	Fault

Related topics

► [I_{max} controller](#)

9096 | 0x2388 **SL-PSM stall detection active**

Keypad display: **SL-PSM stall det.**

Cause	Remedy	Error type/response
Overload of the motor with sensorless control for synchronous motors (SL-PSM).	<ul style="list-style-type: none"> Reduce load at the axis. Check settings of the SL-PSM parameters. 	Trouble <ul style="list-style-type: none"> The inverter is disabled immediately. The motor has no torque (is coasting).

Related topics

► [Sensorless control for synchronous motor \(SL-PSM\)](#)

9098 | 0x238A **Maximum current reached**

Keypad display: **I_{max} reached**

Cause	Remedy	Error type/response
The actual current 0x6078 (P103.00) is equal to or higher than the max. current 0x6073 (P324.00) .	<ul style="list-style-type: none"> Reduce the load on the motor or change the settings for the maximum current. 0x6073 (P324.00) 	Information

12576 | 0x3120 **Mains phase fault**

Keypad display: **Mains Phase fail**

Cause	Remedy	Error type/response
Mains phase failure	<ul style="list-style-type: none"> Check wiring of the mains connection. Check fuses. 	Fault

12672 | 0x3180 **UPS operation active**Keypad display: **UPS oper. active**

Cause	Remedy	Error type/response
Operation on uninterrupted 1x230V current supply (UPS) has been activated: Only a reduced output current is provided.	Switch back to operation with regular mains voltage.	Warning

Related topics

[Operation with UPS](#)12816 | 0x3210 **Fault - DC bus overvoltage**Keypad display: **DC Bus OV**

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 (P208.06)) results from the setting of the rated mains voltage in 0x2540:001 (P208.01) .	<ul style="list-style-type: none"> • Reduce dynamic performance of the load profile. • Check mains voltage. • Check settings for brake energy management. • 0x2541:001 (P706.01) = [0]: Connect brake resistor to the power unit and activate the integrated brake chopper. 	Fault

Related topics

[► Mains voltage](#)[► Brake energy management](#)12817 | 0x3211 **DC bus overvoltage warning**Keypad display: **Warn.DC Bus OV**

Cause	Remedy	Error type/response
DC-bus voltage has exceeded the warning threshold for overvoltage set in 0x2540:005 (P208.05) due to a too high braking energy or a too high mains voltage.	<ul style="list-style-type: none"> • Reduce dynamic performance of the load profile. • Check mains voltage. • Check settings for brake energy management. • 0x2541:001 (P706.01) = [0]: Connect brake resistor to the power unit and activate the integrated brake chopper. 	Warning

Related topics

[► Mains voltage](#)[► Brake energy management](#)12832 | 0x3220 **Fault - DC bus undervoltage**Keypad display: **DC Bus UV**

Cause	Remedy	Error type/response
DC-bus voltage has fallen below the error threshold for undervoltage. The error threshold (display in 0x2540:003 (P208.03)) results from the setting of the rated mains voltage in 0x2540:001 (P208.01) .	<ul style="list-style-type: none"> • Check mains voltage. • 0x2D87 (P105.00) Check DC-bus voltage. • Check mains settings. • Check fuses. 	Trouble

Related topics

[► Mains voltage](#)12833 | 0x3221 **DC bus undervoltage warning**Keypad display: **Warn.DC Bus UV**

Cause	Remedy	Error type/response
DC-bus voltage has fallen below the warning threshold for undervoltage set in 0x2540:002 (P208.02) .	<ul style="list-style-type: none"> • Check mains voltage. • 0x2D87 (P105.00) Check DC-bus voltage. • Check mains settings. • Check fuses. 	Warning

Related topics

[► Mains voltage](#)

12834 | 0x3222 **DC-bus voltage to low for power up**

Keypad display: **DC-bus on-UV**

Cause	Remedy	Error type/response
The input voltage is too low to switch on the inverter.	<ul style="list-style-type: none"> • Check mains voltage. • Check mains settings. • Check fuses. 	Warning

Related topics

► [Mains voltage](#)

16912 | 0x4210 **Fault - Power unit overtemperature**

Keypad display: **PU Overtemp.**

Cause	Remedy	Error type/response
<p>The heatsink temperature of the power unit (display in 0x2D84:001 (P117.01)) has exceeded the fixed error threshold (100 °C).</p> <ul style="list-style-type: none"> • Ambient temperature too high. • Fan or ventilation slots are polluted. • Fan is defective. 	<ul style="list-style-type: none"> • 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 (P117.01). • Clean fan and ventilation slots. If required, replace fan. • Reduce switching frequency 0x2939 (P305.00) 	Fault

17024 | 0x4280 **Fault - Heat sink temperature sensor**

Keypad display: **Heatsink 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**

Keypad display: **Heatsink fan**

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**

Keypad display: **Warn.PU Overtemp**

Cause	Remedy	Error type/response
<p>The heatsink temperature of the power unit (display in 0x2D84:001 (P117.01)) has exceeded the warning threshold set in 0x2D84:002.</p> <ul style="list-style-type: none"> • Ambient temperature too high. • Fan or ventilation slots are polluted. • Fan is defective. 	<ul style="list-style-type: none"> • Provide for a sufficient cooling of the device. • Clean fan and ventilation slots. • If required, replace fan. 	Warning

Related topics

► [Heatsink temperature monitoring](#)

17168 | 0x4310 **Motor overtemperature**Keypad display: **Overtemp. motor**

Cause	Remedy	Error type/response
The motor temperature sensor connected to terminals X109/T1 and X109/T2 measures a too high motor temperature. <ul style="list-style-type: none"> Motor too hot by impermissibly high currents. Motor too hot by frequent and too long acceleration processes. 	<ul style="list-style-type: none"> Check drive dimensioning. Check motor temperature sensor and wiring. 	Fault (configurable)
		<ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 5 s Setting parameters: 0x2D49:002 (P309.02)

Related topics

[▶ Motor temperature monitoring](#)
20754 | 0x5112 **24 V supply critical**Keypad display: **24V supply low**

Cause	Remedy	Error type/response
24V voltage failed or too low.	<ul style="list-style-type: none"> Check optional external 24V voltage supply (terminal X3/24E), if connected. Check mains voltage. 	Warning

20864 | 0x5180 **Overload 24 V supply**Keypad display: **Overload 24V**

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.	Warning

21376 | 0x5380 **OEM hardware incompatible**Keypad display: **Incomp. OEM HW**

Cause	Remedy	Error type/response
The control unit (OEM hardware) is not compatible with the power unit (OEM hardware).	<ul style="list-style-type: none"> Use compatible hardware. Contact the OEM. 	Fault <ul style="list-style-type: none"> The inverter is disabled immediately. The motor has no torque (is coasting). The error can only be reset by mains switching.

24970 | 0x618A **Warning - Internal fan**Keypad display: **Internal fan**

Cause	Remedy	Error type/response
Warning of the internal fan.	Check/replace internal fan.	Warning

25216 | 0x6280 **Trigger/functions connected incorrectly**Keypad display: **P400 config err**

Cause	Remedy	Error type/response
The assignment directives have not been observed. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> With keypad or network control, the two "Enable inverter 0x2631:001 (P400.01)" and "Run 0x2631:002 (P400.02)" functions can also be set to "Constant TRUE [1]" to start the motor. 	Trouble

Related topics

[▶ Start, stop and rotating direction commands](#)

25217 | 0x6281 **User-defined fault 1**Keypad display: **User 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 (P400.43) .	Eliminate error cause and then reset error.	Fault

Related topics

► [User-defined error triggering](#)

25218 | 0x6282 **User-defined fault 2**Keypad display: **User 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 (P400.44) .	Eliminate error cause and then reset error.	Fault

Related topics

► [User-defined error triggering](#)

25232 | 0x6290 **Warning invert rotation**Keypad display: **Invert rotation**

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> Negative setpoint selection with an active limitation of rotation 0x283A (P304.00). The "Reverse rotational direction" 0x2631:013 (P400.13) function was requested with an active limitation of rotation 0x283A (P304.00). 	<ul style="list-style-type: none"> Check setpoint selection and trigger. Check setting in 0x283A (P304.00). 	Warning <ul style="list-style-type: none"> 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](#)

25233 | 0x6291 **Maximum allowed troubles exceeded**Keypad display: **Trouble overflow**

Cause	Remedy	Error type/response
The number of permitted restart attempts after a fault set in 0x2839:003 (P760.03) was exceeded. The fault occurred to frequently and could not be reset.	Check and the eliminate the fault.	Fault <ul style="list-style-type: none"> The motor remains at a standstill, no automatic restart is executed.

Related topics

► [Automatic restart after a fault](#)

25248 | 0x62A0 **User-defined fault (LECOM)**Keypad display: **UserFault(LECOM)**

Cause	Remedy	Error type/response
The "Activate fault" function was triggered via bit 10 of the LECOM control word 0x400B:002 (P592.02) .	Eliminate error cause and then reset error.	Fault

25249 | 0x62A1 **Network: user fault 1**Keypad display: **Netw.UserFault1**

Cause	Remedy	Error type/response
The "Activate fault 1" function was triggered via the NetWordIN1 data word 0x4008:001 (P590.01) .	Eliminate error cause and then reset error.	Fault

Related topics

► [Define your own control word format](#)

25250 | 0x62A2 **Network: user fault 2**Keypad display: **Netw.UserFault2**

Cause	Remedy	Error type/response
The "Activate fault 2" function was triggered via the NetWordIN1 data word 0x4008:001 (P590.01) .	Eliminate error cause and then reset error.	Fault

Related topics

► [Define your own control word format](#)

25265 | 0x62B1 **NetWordIN1 configuration incorrect**Keypad display: **NetWordIN1error**

Cause	Remedy	Error type/response
Two bits of the NetWordIN1 data word 0x4008:001 (P590.01) were assigned to the same function.	Check and correct configuration of the NetWordIN1 data word. <ul style="list-style-type: none"> The functions that are to be triggered via bits 0 ... 15 of the NetWordIN1 data word are defined in 0x400E:001 (P505.01) ... 0x400E:016 (P505.16). 	Trouble

Related topics

► [Define your own control word format](#)

25266 | 0x62B2 **Device ID has been changed**Keypad display: **Dev. ID changed**

Cause	Remedy	Error type/response
The device ID of the device was changed manually.	<ol style="list-style-type: none"> Execute device command "Save user data" 0x2022:003 (P700.03). Switch inverter off and on again. 	Fault

Related topics

► [Saving/loading the parameter settings](#)

25505 | 0x63A1 **CU: load error ID tag**Keypad display: **CU ID tag error**

Cause	Remedy	Error type/response
Calibration data of the control unit not compatible or faulty.	<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> The inverter is disabled immediately. The motor has no torque (is coasting). The error can only be reset by mains switching.

25506 | 0x63A2 **PU: load error ID tag**Keypad display: **PU ID tag error**

Cause	Remedy	Error type/response
Calibration data of the power unit not compatible or faulty.	<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> The inverter is disabled immediately. The motor has no torque (is coasting). The error can only be reset by mains switching.

25507 | 0x63A3 **Power unit unknown**Keypad display: **PU 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 <ul style="list-style-type: none"> The inverter is disabled immediately. The motor has no torque (is coasting). The error can only be reset by mains switching.

28800 | 0x7080 **Assertion level monitoring (Low/High)**Keypad display: **Assertionlevel**

Cause	Remedy	Error type/response
The last setting of the connection level differs from the saved setting.	<ol style="list-style-type: none"> 1. Execute device command "Save user data" 0x2022:003 (P700.03). 2. Switch inverter off and on again. 	Fault

28801 | 0x7081 **Fault - Analog input 1**Keypad display: **AI1 fault**

Cause	Remedy	Error type/response
The monitoring function of the input signal configured for analog input 1 in 0x2636:008 (P430.08) and 0x2636:009 (P430.09) has been triggered.	<ul style="list-style-type: none"> • Check input signal at analog input 1. • Check configuration of the monitoring function. 	Fault (configurable) Setting parameters: 0x2636:010 (P430.10)

Related topics

[▶ Analog input 1](#)
28802 | 0x7082 **Analog input 2 fault**Keypad display: **AI2 fault**

Cause	Remedy	Error type/response
The monitoring function of the input signal configured for analog input 2 in 0x2637:008 (P431.08) and 0x2637:009 (P431.09) has been triggered.	<ul style="list-style-type: none"> • Check input signal at analog input 2. • Check configuration of the monitoring function. 	Fault (configurable) Setting parameters: 0x2637:010 (P431.10)

Related topics

[▶ Analog input 2](#)
28803 | 0x7083 **HTL input fault**Keypad display: **HTL input fault**

Cause	Remedy	Error type/response
The monitoring of the input signal configured for the HTL input has been triggered.	<ul style="list-style-type: none"> • Check input signal at the HTL input. • Check configuration of the monitoring function. 	No response (configurable) Setting parameters: 0x2641:006 (P416.06)

Related topics

[▶ Configure digital inputs DI3/DI4 for detecting a pulse train](#)
28833 | 0x70A1 **Analog output 1 fault**Keypad display: **AO1 fault**

Cause	Remedy	Error type/response
Open circuit or short circuit at analog output 1.	<ul style="list-style-type: none"> • Check wiring of analog output 1. • Check definition of the output range in 0x2639:001 (P440.01). 	Warning

Related topics

[▶ Analog output 1](#)
28834 | 0x70A2 **Analog output 2 fault**Keypad display: **AO2 fault**

Cause	Remedy	Error type/response
Open circuit or short circuit at analog output 2.	<ul style="list-style-type: none"> • Check wiring of analog output 2. • Check definition of the output range in 0x263A:001 (P441.01). 	Warning

Related topics

[▶ Analog output 2](#)

28961 | 0x7121 **Fault - Pole position identification**

Keypad display: **Pole pos. error**

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> Too many deviations during the pole position identification. Compared to the inverter, the rated motor current is too high or too low. 	<ul style="list-style-type: none"> 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 (configurable) Setting parameters: 0x2C60

29056 | 0x7180 **Motor overcurrent**

Keypad display: **Mot max current**

Cause	Remedy	Error type/response
The motor current has exceeded the warning/error threshold for the motor current monitoring set in 0x2D46:001 (P353.01) .	<ul style="list-style-type: none"> Check motor load. Check drive dimensioning. Check warning threshold or error threshold set in 0x2D46:001 (P353.01). 	Fault (configurable) <ul style="list-style-type: none"> The error can only be reset after a blocking time. Blocking time: 1 s Setting parameters: 0x2D46:002 (P353.02)

Related topics

► [Overcurrent monitoring](#)

29445 | 0x7305 **Encoder open circuit**

Keypad display: **Encoder error**

Cause	Remedy	Error type/response
The encoder signal loss monitoring function has detected a failure of the encoder signal.	<ul style="list-style-type: none"> Check the encoder connection. Check encoder cable for wire breakage. Check encoder current supply. 	Warning (configurable) Setting parameters: 0x2C45 (P342.00)

Related topics

► [Encoder monitoring](#)

29573 | 0x7385 **Feedback system: speed limit**

Keypad display: **F.fdb spd limit**

Cause	Remedy	Error type/response
The feedback system exceeds the maximum permissible frequency range of the digital inputs.	Check feedback system.	Warning

Related topics

► [Encoder monitoring](#)

30336 | 0x7680 **Memory module is full**

Keypad display: **EPM full**

Cause	Remedy	Error type/response
The memory module contains too many parameter settings.	Execute "Save user data" 0x2022:003 (P700.03) device command again. This reinitialises the user memory with the current parameter settings. In this way, parameter settings that are no longer required are automatically deleted.	Warning <ul style="list-style-type: none"> The parameter settings were not saved in the memory module.

30337 | 0x7681 **Memory module not present**

Keypad display: **EPM not present**

Cause	Remedy	Error type/response
The inverter memory module was removed.	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!	Fault <ul style="list-style-type: none"> The default setting stored in the inverter firmware has been loaded. The error cannot be reset by the user.

30338 | 0x7682 **Memory module: Invalid user data**Keypad display: **EPM invalid data**

Cause	Remedy	Error type/response
The user parameter settings in the memory module are invalid.	<ol style="list-style-type: none"> 1. Execute user parameter settings again. 2. Execute device command "Save user data" 0x2022:003 (P700.03). 	Fault <ul style="list-style-type: none"> • The user parameter settings are lost. • The default settings were automatically loaded.

30340 | 0x7684 **Data not compl. saved before powerdown**Keypad display: **Save incomplete**

Cause	Remedy	Error type/response
Saving of the parameter settings was interrupted by an unexpected disconnection.	<ol style="list-style-type: none"> 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 (P700.03). 	Warning <ul style="list-style-type: none"> • The user parameter settings were not fully saved. • At the next switch-on, the data stored are copied to the user memory.

30345 | 0x7689 **Memory module: invalid OEM data**Keypad display: **OEM data invalid**

Cause	Remedy	Error type/response
The OEM memory contains invalid parameter settings or is empty.	<ul style="list-style-type: none"> • Execute device command "Save OEM data" 0x2022:006 (P700.06). • Thus, the user parameter settings get lost! 	Warning <ul style="list-style-type: none"> • The user parameter settings were automatically loaded.

30346 | 0x768A **Memory module: wrong type**Keypad display: **Wrong EPM**

Cause	Remedy	Error type/response
The memory module connected is not supported by the inverter.	<ol style="list-style-type: none"> 1. Switch off inverter. 2. Replace plugged-in memory module by a memory module that matches the inverter. 3. Switch the inverter on again. 	Fault <ul style="list-style-type: none"> • The default setting stored in the inverter firmware has been loaded. • The error cannot be reset by the user.

30352 | 0x7690 **EPM firmware version incompatible**Keypad display: **EPM-FW incompat.**

Cause	Remedy	Error type/response
The parameter settings saved in the memory module are incompatible with the firmware version.	<ol style="list-style-type: none"> 1. Execute device command "Load default settings" 0x2022:001 (P700.01). 2. Execute "Save user data" 0x2022:003 (P700.03) or "Save OEM data" 0x2022:006 (P700.06) device command. 	Fault <ul style="list-style-type: none"> • The data have been loaded into the RAM memory, but they are incompatible.

30353 | 0x7691 **EPM data: firmware type incompatible**Keypad display: **EPM: FW incompat.**

Cause	Remedy	Error type/response
The parameter settings saved in the memory module are incompatible with the firmware type. Example: Memory module of an inverter with an application IO is used in an inverter with a standard IO.	<ol style="list-style-type: none"> 1. Execute device command "Load default settings" 0x2022:001 (P700.01). 2. Execute "Save user data" 0x2022:003 (P700.03) or "Save OEM data" 0x2022:006 (P700.06) device command. 	Fault <ul style="list-style-type: none"> • The data have been loaded into the RAM memory, but they are incompatible.

30354 | 0x7692 **EPM data: new firmware type detected**

Keypad display: **UserCU not match**

Cause	Remedy	Error type/response
The parameter settings saved in the memory module do not match the inverter hardware.	<ol style="list-style-type: none"> 1. Check parameter settings. 2. Reset error. 3. Execute "Save user data" 0x2022:003 (P700.03) or "Save OEM data" 0x2022:006 (P700.06) device command. 	Fault <ul style="list-style-type: none"> • The data have been loaded into the RAM memory without being modified, and they are compatible. • The settings loaded must be accepted by the user (see remedy).

30355 | 0x7693 **EPM data: PU size incompatible**

Keypad display: **EPM PU size inco**

Cause	Remedy	Error type/response
The parameter settings saved in the memory module are incompatible with the inverter.	<ol style="list-style-type: none"> 1. Execute device command "Load default settings" 0x2022:001 (P700.01). 2. Execute "Save user data" 0x2022:003 (P700.03) or "Save OEM data" 0x2022:006 (P700.06) device command. 	Fault <ul style="list-style-type: none"> • The data have been loaded into the RAM memory, but they are incompatible.

30356 | 0x7694 **EPM data: new PU size detected**

Keypad display: **EPM new PU size**

Cause	Remedy	Error type/response
The parameter settings saved in the memory module comply with a different hardware. Example: Memory module of an inverter with a power of 3 kW is used in an inverter with a power of 18.5 kW.	<ol style="list-style-type: none"> 1. Check parameter settings. 2. Reset error. 3. Execute "Save user data" 0x2022:003 (P700.03) or "Save OEM data" 0x2022:006 (P700.06) device command. 	Fault <ul style="list-style-type: none"> • The data have been loaded into the RAM memory without being modified, and they are compatible. • The settings loaded must be accepted by the user (see remedy).

30357 | 0x7695 **Invalid parameter changeover configuration**

Keypad display: **InvalidChgovrCfg**

Cause	Remedy	Error type/response
One or more parameters can no longer be used for the "Parameter change-over" function.	<ol style="list-style-type: none"> 1. Check error message for parameter change-over in 0x4047:001 (P756.01). 2. Correct the list entry shown in 0x4047:002 (P756.02). 	Warning <ul style="list-style-type: none"> • The parameter change-over function is deactivated.

30358 | 0x7696 **EPM data: unknown parameter found**

Keypad display: **Unkn. Par in EPM**

Cause	Remedy	Error type/response
The memory module contains parameter settings for one or several parameters that are not known to the inverter.	Execute the "Save user data" 0x2022:003 (P700.03) device command. This reinitialises the user memory with the current parameter settings. In this way, parameter settings that are no longer required are automatically deleted.	Information

30359 | 0x7697 **Parameter changes lost**

Keypad display: **Parameter loss**

Cause	Remedy	Error type/response
A voltage failure has occurred and changed parameter settings that had not been saved yet were available.	<ol style="list-style-type: none"> 1. Execute parameter settings again. 2. Execute device command "Save user data" 0x2022:003 (P700.03). 	Fault <ul style="list-style-type: none"> • The parameter settings changed have been lost.

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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 (P515.06)

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> EtherNet/IP: the maximum permissible time-out period for the CIP communication set in 0x23A1:010 (P510.10) has been exceeded. Modbus TCP/IP: the maximum permissible time-out period for the TCP communication set in 0x23B1:010 (P510.10) has been exceeded. 	<ul style="list-style-type: none"> Check cables and terminals. Connect network cable. 	Warning (configurable)
		Setting parameters: 0x2859:007 (P515.07) (EtherNet/IP) 0x2859:007 (P515.07) (Modbus TCP)

Cause	Remedy	Error type/response
The parameter access monitoring (PAM) function has been activated. For a time longer than the time-out period set in 0x2552:003 (P595.03) , no value was entered into the "Keep-alive-Register" 0x2552:002 (P595.02) .	<ul style="list-style-type: none"> Check communication. Check settings of the parameter access monitoring (PAM) function. 	No response (configurable)
		Setting parameters: 0x2552:004 (P595.04)

Related topics

► [Parameter access monitoring \(PAM\)](#)

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 (P514.01) .	Check communication with the master.	Fault (configurable)
		Setting parameters: 0x2859:008 (P515.08)

Related topics

► [Monitoring](#)

Cause	Remedy	Error type/response
For a time longer than the time-out period set in 0x23B6:002 (P514.02) , no value was entered into the Keep alive register 0x23B6:005 (P514.05) .	Check communication with the master.	Fault (configurable)
		Setting parameters: 0x2859:009 (P515.09)

Related topics

► [Monitoring](#)

33154 | 0x8182 **CAN: bus off**

Keypad display: **CAN bus off**

Cause	Remedy	Error type/response
Too many faulty frames have been received. <ul style="list-style-type: none"> Defective cable (e. g. loose contact). Two nodes with the same node address. 	<ul style="list-style-type: none"> Check wiring of the network. Check bus terminating resistor. Set the identical baud rate for each node of the network. Assign a unique node address to each node of the network. Eliminate EMC interferences. 	Trouble (configurable) <ul style="list-style-type: none"> Change to the "Bus-Off" communication status.
		Setting parameters: 0x2857:010

33155 | 0x8183 **CAN: warning**

Keypad display: **CAN bus warning**

Cause	Remedy	Error type/response
Too many faulty frames have been received. <ul style="list-style-type: none"> Defective cable (e. g. loose contact). Two nodes with the same node address. 	<ul style="list-style-type: none"> Check wiring of the network. Check bus terminating resistor. Set the identical baud rate for each node of the network. Assign a unique node address to each node of the network. Eliminate EMC interferences. 	Warning (configurable)
		Setting parameters: 0x2857:011

33156 | 0x8184 **CAN: heartbeat time-out consumer 1**

Keypad display: **CAN heartb. C1**

Cause	Remedy	Error type/response
Within the heartbeat time 0x1016:001 (P520.01) , no heartbeat telegram was received by node 1 to be monitored.	<ul style="list-style-type: none"> Check communication with the heartbeat producer. Reactivate heartbeat producer. 	Fault (configurable)
		Setting parameters: 0x2857:005

Related topics

► [Heartbeat protocol](#)

33157 | 0x8185 **CAN: heartbeat time-out consumer 2**

Keypad display: **CAN heartb. C2**

Cause	Remedy	Error type/response
Within the heartbeat time 0x1016:002 (P520.02) , no heartbeat telegram was received by node 2 to be monitored.	<ul style="list-style-type: none"> Check communication with the heartbeat producer. Reactivate heartbeat producer. 	Fault (configurable)
		Setting parameters: 0x2857:006

Related topics

► [Heartbeat protocol](#)

33158 | 0x8186 **CAN: heartbeat time-out consumer 3**

Keypad display: **CAN heartb. C3**

Cause	Remedy	Error type/response
Within the heartbeat time 0x1016:003 (P520.03) , no heartbeat telegram was received by node 3 to be monitored.	<ul style="list-style-type: none"> Check communication with the heartbeat producer. Reactivate heartbeat producer. 	Fault (configurable)
		Setting parameters: 0x2857:007

Related topics

► [Heartbeat protocol](#)

33159 | 0x8187 **CAN: heartbeat time-out consumer 4**

Keypad display: **CAN heartb. C4**

Cause	Remedy	Error type/response
Within the heartbeat time 0x1016:004 (P520.04) , no heartbeat telegram was received by node 4 to be monitored.	<ul style="list-style-type: none"> Check communication with the heartbeat producer. Reactivate heartbeat producer. 	Fault (configurable)
		Setting parameters: 0x2857:008

Related topics

► [Heartbeat protocol](#)

33168 | 0x8190 **Network: watchdog timeout**Keypad display: **Watchdog timeout**

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.	<ul style="list-style-type: none"> Check wiring of the network. Eliminate EMC interferences. 	Trouble (configurable) Setting parameters: 0x2859:001 (P515.01) (PROFIBUS) 0x2859:001 (P515.01) (EtherCAT) 0x2859:001 (P515.01) (EtherNet/IP) 0x2859:001 (P515.01) (PROFINET) 0x2859:001 (P515.01) (POWERLINK)

33169 | 0x8191 **Network: disruption of cyclic data exchange**Keypad display: **Cycl data error**

Cause	Remedy	Error type/response
The communication partner has interrupted the cyclic data exchange.	<ul style="list-style-type: none"> 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. 	No response (configurable) Setting parameters: 0x2859:002 (P515.02)

33170 | 0x8192 **Network: initialisation error**Keypad display: **Net. Init. 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 (P515.04) (PROFIBUS) 0x2859:004 (P515.04) (EtherCAT) 0x2859:004 (P515.04) (EtherNet/IP) 0x2859:004 (P515.04) (PROFINET) 0x2859:004 (P515.04) (Modbus TCP)

33171 | 0x8193 **Network: invalid cyclic process data**Keypad display: **Inv. cyclic 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 (P515.05) (PROFIBUS) 0x2859:005 (P515.05) (EtherCAT) 0x2859:005 (P515.05) (EtherNet/IP) 0x2859:005 (P515.05) (PROFINET)

33185 | 0x81A1 **Modbus: network time-out**Keypad display: **Modbus time-out**

Cause	Remedy	Error type/response
No valid messages have been received via the Modbus for a longer time than the time-out time set in 0x2858:002 (P515.02) .	<ul style="list-style-type: none"> Check communication with the master. Check wiring. Check bus termination. 	Fault (configurable) Setting parameters: 0x2858:001 (P515.01)

33186 | 0x81A2 **Modbus: incorrect request by master**Keypad display: **Modbus request**

Cause	Remedy	Error type/response
The request by the master is invalid, e. g. invalid CRC checksum, non-supported function code, or impermissible data access.	Check request by the master: <ul style="list-style-type: none"> Value in the valid range? Function code valid? No impermissible write access? (e. g. with regard to read-only parameters) 	Warning The inverter (slave) responds to the master with an error code: <ul style="list-style-type: none"> 0x01 = invalid function code 0x02 = invalid data address 0x03 = invalid data value 0x04 = slave device failure

Cause	Remedy	Error type/response
In case of the Ethernet communication interface, an internal software error has occurred.	<ul style="list-style-type: none"> Switch inverter off and on again. In the event of a power failure during a firmware download, it is required to reload the firmware via the USB module and then restart the inverter. 	Trouble

Related topics

► [Firmware download with »Remote Sinus \(firmware loader\)«](#)

Cause	Remedy	Error type/response
SoC of master was not received.	Check configuration and system setup.	Trouble (configurable)
		Setting parameters: 0x2859:011

Cause	Remedy	Error type/response
CRC frame defective.	Check system setup.	Trouble (configurable)
		Setting parameters: 0x2859:010

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> 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 (P515.03) (PROFIBUS) 0x2859:003 (P515.03) (EtherCAT) 0x2859:003 (P515.03) (EtherNet/IP) 0x2859:003 (P515.03) (PROFINET) 0x2859:003 (P515.03) (Modbus TCP)

Cause	Remedy	Error type/response
RPDO1 was not received within the time-out period set in 0x1400:005 (P540.05) or with the sync configured.	<ul style="list-style-type: none"> Eliminate EMC interferences. Check bus load. 	Fault (configurable)
		Setting parameters: 0x2857:001

Related topics

► [Process data transfer](#)

Cause	Remedy	Error type/response
RPDO2 was not received within the time-out period set in 0x1401:005 (P541.05) or with the sync configured.	<ul style="list-style-type: none"> Eliminate EMC interferences. Check bus load. 	Fault (configurable)
		Setting parameters: 0x2857:002

Related topics

► [Process data transfer](#)

33427 | 0x8293 **CAN: RPDO3 time-out**Keypad display: **Timeout RPDO3**

Cause	Remedy	Error type/response
RPDO3 was not received within the time-out period set in 0x1402:005 (P542.05) or with the sync configured.	<ul style="list-style-type: none"> Eliminate EMC interferences. Check bus load. 	Fault (configurable)
		Setting parameters: 0x2857:003

Related topics

[▶ Process data transfer](#)
33553 | 0x8311 **Torque limit reached**Keypad display: **Torque limit**

Cause	Remedy	Error type/response
Motor has reached the torque limit: <ul style="list-style-type: none"> 0x2949:003 (P337.03): Actual positive torque limit 0x2949:004 (P337.04): Actual negative torque limit 	<ul style="list-style-type: none"> Observe load requirements. Reduce motor load. Check set torque limits and sources for the torque limits. 	No response (configurable)
		Setting parameters: 0x2D67:001 (P329.01)

Related topics

[▶ Motor torque monitoring](#)
33664 | 0x8380 **Function not allowed in selected operating mode**Keypad display: **Func. n. allowed**

Cause	Remedy	Error type/response
The selected function is not permissible in the chosen operating mode. <ul style="list-style-type: none"> Selection of torque mode [-1] in 0x6060 (P301.00) with incompatible motor control in 0x2C00 (P300.00). Selection of invalid drive mode [0] in 0x6060 (P301.00). 	<ul style="list-style-type: none"> Note: selection of torque mode [-1] in 0x6060 (P301.00) with incompatible motor control in 0x2C00 (P300.00). Check settings of operation modes. 0x6060 (P301.00) 	Warning

36992 | 0x9080 **Keypad removed**Keypad display: **Keypad removed**

Cause	Remedy	Error type/response
The keypad was removed while the keypad control was activated.	<ul style="list-style-type: none"> Plug keypad back in or activate another control source. 	Fault

Related topics

[▶ Changing the control source during operation](#)
65282 | 0xFF02 **Fault - Brake resistor overload**Keypad display: **BrkResistor OL.F**

Cause	Remedy	Error type/response
The calculated thermal load of the brake resistor has reached the error threshold set in 0x2550:009 (P707.09) . The regenerative energy is too high.	<ul style="list-style-type: none"> Check drive dimensioning. Check settings for the brake energy management. Note: The error status will be reset if the thermal load falls below the error threshold - 20 %.	Fault (configurable)
		<ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 5 s Setting parameters: 0x2550:011 (P707.11)

Related topics

[▶ Use of a brake resistor](#)

Cause	Remedy	Error type/response
The safety module or safety circuit of the device was detected as being defective.	Hardware error: it is necessary to contact the manufacturer since the device must be replaced.	Fault <ul style="list-style-type: none"> The inverter is disabled immediately. The motor has no torque (is coasting). The error can only be reset by mains switching.

Cause	Remedy	Error type/response
The motor speed has reached the error threshold for overspeed set in 0x2D44:001 (P350.01) .	Adapt the maximum motor speed 0x6080 (P322.00) and the warning threshold or error threshold 0x2D44:001 (P350.01) .	Fault (configurable) <ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 1 s
		Setting parameters: 0x2D44:002 (P350.02)

Related topics

[► Motor speed monitoring](#)

Cause	Remedy	Error type/response
A failure of several motor phases has been detected.	<ul style="list-style-type: none"> Check wiring between inverter and motor. In case of a false tripping, adapt the settings for the motor phase failure detection. 	No response (configurable) <ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001 (P310.01)

Related topics

[► Motor phase failure detection](#)

Cause	Remedy	Error type/response
A failure of the motor phase U has been detected.	<ul style="list-style-type: none"> Check wiring between inverter and motor. In case of a false tripping, adapt the settings for the motor phase failure detection. 	No response (configurable) <ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001 (P310.01)

Related topics

[► Motor phase failure detection](#)

Cause	Remedy	Error type/response
A failure of the motor phase V has been detected.	<ul style="list-style-type: none"> Check wiring between inverter and motor. In case of a false tripping, adapt the settings for the motor phase failure detection. 	No response (configurable) <ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001 (P310.01)

Related topics

[► Motor phase failure detection](#)

65292 | 0xFF0C **Motor phase failure phase W**Keypad display: **Phase W failure**

Cause	Remedy	Error type/response
A failure of the motor phase W has been detected.	<ul style="list-style-type: none"> Check wiring between inverter and motor. In case of a false tripping, adapt the settings for the motor phase failure detection. 	No response (configurable)
		<ul style="list-style-type: none"> The error can only be reset after a blocking time.
		Blocking time: 2 s
		Setting parameters: 0x2D45:001 (P310.01)

Related topics

► [Motor phase failure detection](#)

65305 | 0xFF19 **Motor parameter identification fault**Keypad display: **Motor ID fault**

Cause	Remedy	Error type/response
During the automatic identification of the motor, an error has occurred.	<ul style="list-style-type: none"> Set motor data so that they comply with the data on the motor nameplate. Check wiring of the motor. 	Fault

65311 | 0xFF1F **FMF Error**Keypad display: **FMF Error**

Cause	Remedy	Error type/response
Configuration or runtime error	<ul style="list-style-type: none"> Check configuration Check FMF error code 0x4050:002 to determine the error cause. 	Fault

65317 | 0xFF25 **Cascading overload**Keypad display: **Cascad. overload**

Cause	Remedy	Error type/response
Cascade function for pumps and fans The maximum frequency in 0x2916 (P211.00) has been reached and no free additional pump is available.	<ul style="list-style-type: none"> Check configuration of the cascade function. Check drive sizing. 	Warning

Related topics

► [Cascade function for pumps and fans](#)

65334 | 0xFF36 **Warning - Brake resistor overload**Keypad display: **BrkResistorOL.W**

Cause	Remedy	Error type/response
The calculated thermal load of the brake resistor has reached the warning threshold set in 0x2550:008 (P707.08) . The regenerative energy is too high.	<ul style="list-style-type: none"> Check drive dimensioning. Check settings for the brake energy management. <p>Note: The warning status is reset if the thermal load falls below the warning threshold of - 20 %.</p>	Warning (configurable)
		Setting parameters: 0x2550:010 (P707.10)

Related topics

► [Use of a brake resistor](#)

65335 | 0xFF37 **Automatic start disabled**Keypad display: **Auto start disab**

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 (P203.02) to "Off [0]".	Deactivate starting command and reset error.	Fault

65336 | 0xFF38 **Load loss detected**Keypad display: **Load loss**

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 (P710.01)) for the period of time specified in Load loss detection: delay time (0x4006:002 (P710.02)), load loss protection is triggered.	Check utilisation	No response (configurable) Setting parameters: 0x4006:003 (P710.03)

65337 | 0xFF39 **Motor overload**Keypad display: **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**Keypad display: **Max. motor freq.**

Cause	Remedy	Error type/response
<ul style="list-style-type: none"> The limitation of the maximum motor speed set in 0x6080 (P322.00) is active. The maximum output frequency of the inverter has been reached. Depending on the parameter setting of 0x2D44:001 (P350.01) (Overspeed monitoring: threshold), the speed limitation (0x6080 / Max. motor speed) may become active before speed monitoring. 	Check application.	Warning

65370 | 0xFF5A **Manual mode deactivated**Keypad display: **Man. mode deact.**

Cause	Remedy	Error type/response
Indicates the deactivation of the manual speed control.		Warning

65371 | 0xFF5B **Manual mode activated**Keypad display: **Man. mode act.**

Cause	Remedy	Error type/response
Indicates the activation of the manual speed control.		Warning

65372 | 0xFF5C **Manual mode time-out**Keypad display: **ManMode 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

65393 | 0xFF71 **Wrong password**
display: **Wrong password**

Keypad

Cause	Remedy	Error type/response
A wrong password has been entered several times.	Wait until the blocking time has elapsed and then enter the correct password.	Warning <ul style="list-style-type: none"> The blocking time for entering a password is more than 10 seconds. (The blocking time is doubled every time an incorrect password is entered.) No password can be entered as long as the blocking time is active.

Related topics

► [Access protection](#)

65394 | 0xFF72 **Warning**
display: **Warning**

Keypad

Cause	Remedy	Error type/response
Inverter is not compatible with the Controller/PLC (brand protection). <ul style="list-style-type: none"> The Controller has not written a deactivation password in the parameter yet. The deactivation password written by the Controller is incorrect. 	Use corresponding (compatible) OEM components.	Warning <ul style="list-style-type: none"> No response from the inverter. The decision on whether the machine will be commissioned or not is made by the Controller.

Related topics

► [Access protection](#)

65395 | 0xFF73 **Fatal Error**
display: **Fatal Error**

Keypad

Cause	Remedy	Error type/response
Error when reading the data from the control unit.	<ul style="list-style-type: none"> Switch inverter off and on again. If the error occurs again, the manufacturer must be contacted, since the control unit or the device has to be replaced. 	Fault <ul style="list-style-type: none"> Operation of the inverter is not possible.

65396 | 0xFF74 **Power unit fatal error**
display: **PU fatal error**

Keypad

Cause	Remedy	Error type/response
Error when reading the data from the power unit.	<ul style="list-style-type: none"> Switch inverter off and on again. If the error occurs again, the manufacturer must be contacted, since the power unit or the device has to be replaced. 	Fault <ul style="list-style-type: none"> Operation of the inverter is not possible.

65413 | 0xFF85 **Keypad full control active**
display: **Keypad full ctrl**

Keypad

Cause	Remedy	Error type/response
If the "Keypad Full Control" control mode is active.	To exit the control mode, press the keypad key CTRL .	Warning <ul style="list-style-type: none"> Both the activity of controlling and the setpoint selection are carried out via the keypad.

Related topics

► [Keypad full control](#)

5. Appendix

5.1 Glossary

Abbreviation	Meaning
AIE	Acknowledge In Error, error acknowledgement
AIS	Acknowledge In Stop, restart acknowledgement
OFF state	Triggered signal status of the 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 sensor 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 in accordance with EN ISO 13849-1
OSSD	Output Signal Switching Device, tested signal output
PELV	Protective Extra Low Voltage, extra-low voltage with safe isolation
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 crawling speed
SD-In	Safe Digital Input
SD-Out	Safe Digital Output
SELV	Safety Extra Low Voltage
SFF	Safe Failure Fraction
SIL	Safety Integrity Level in accordance with IEC 61508