

# **AXIA VERT**

## **Communication Module Manual**

### **CMA-CAN-01**

Frequency inverter 400 V  
0,25 kW ... 15 kW





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## 1 General Information about the Documentation

For better clarity, the documentation of the frequency inverter is structured according to the customer-specific requirements.

The present manual was created in the German language. The German manual is the original version. Other language versions are translated.

### Quick Start Guide

The "Quick Start Guide" describes the basic steps required for mechanical and electrical installation of the frequency inverter. The guided commissioning supports you in the selection of necessary objects and the configuration of the software of the frequency inverter.

### User manual

The user manual documents the complete functionality of the frequency inverter. The objects required for special purposes, for adjustment to the application and the numerous additional functions are described in detail.

Separate user manuals are supplied for optional components for the frequency inverter. These manuals complement the operating instructions and the "Quick Start Guide" for the frequency inverter.

### Application manual

The application manual complements the documentation to ensure goal-directed installation and commissioning of the frequency inverter. Information on various topics in connection with the use of the frequency inverter is described in context with the specific application.

### Installation instructions

The installation manual describes the installation and use of devices, complementing the "Quick Start Guide" and the user manual.

## 1.1 This document

The present user manual for the CMA-CAN-01 communication module complements the Operating Instructions and the "Quick Start Guide" for the frequency inverters of the AXIA device series.

The user manual contains important information on the installation and use of the CANopen® communication module CMA-CAN in its specified application range. Compliance with user documentation contributes to avoiding risks, minimizing repair cost and downtimes and increasing the reliability and service life of the frequency inverter.

For this reason, make sure you read the user manual carefully.

### IMPORTANT:

**Compliance with the documentation is required to ensure safe operation of the frequency inverter. Bonfiglioli Deutschland GmbH shall not be held liable for any damage caused by any non-compliance with the documentation.**



In case any problems occur which are not covered by the documentation sufficiently, please contact the manufacturer.



For safe commissioning and operation of the AXV (AXIA) series, the following documentation must be complied with:

- The Operating Instructions Document
- Safety manual "Safety Manual AXV"

## 1.2 Warranty and liability

BONFIGLIOLI Deutschland GmbH (hereinafter referred to as "manufacturer") notes that the contents of this Operating Instructions document do not form part of any previous or existing agreement, assurance or legal relationship between the manufacturer and the user of these

Operating Instructions (hereinafter referred to as the "User"). Neither are they intended to supplement or replace such agreements, assurances or legal relationships. Any obligations of the manufacturer shall solely be based on the relevant purchase agreement which also includes the complete and solely valid warranty stipulations. These contractual warranty provisions are neither extended nor limited by the specifications contained in this documentation.

The manufacturer reserves the right to correct or amend the specifications, product information and omissions in these operating instructions without prior notice. The manufacturer assumes no responsibility to update these Operating Instructions. The manufacturer shall not be liable for any damage, injuries or costs which may be caused by the aforementioned reasons.

In addition, the manufacturer excludes any warranty and disclaims all liability, including without limitation direct, indirect, special, punitive, incidental, exemplary or consequential damages arising out of or in connection with one or more of the following causes:

- inappropriate use of the frequency inverter,
- non-compliance with the instructions, warnings and prohibitions contained in the documentation,
- unauthorized modifications of the frequency inverter,
- insufficient monitoring of parts of the machine/plant which are subject to wear,
- repair work at the machine/plant not carried out properly or in time,
- catastrophes by external impact and Force Majeure.

### **1.1 Obligation**

These Operating Instructions must be read before commissioning and complied with. Anybody entrusted with tasks in connection with the

- transport,
- assembly,
- installation of the frequency inverter and
- operation of the frequency inverter

must have read and understood the Operating Instructions and, in particular, the safety instructions in order to prevent personal and material losses.

### **1.2 Copyright**

In accordance with applicable law any copyrights relating to this document shall remain with  
BONFIGLIOLI Deutschland GmbH  
Europark Fichtenhain B6  
47807 Krefeld  
Germany

This document is intended for the operator of the frequency inverter. Any disclosure or copying of this document, exploitation and communication of its contents (as hardcopy or electronically) shall be forbidden, unless permitted expressly.

Any non-compliance will constitute an offense against the copyright law, the law against unfair competition and the German Civil Code and may result in claims for damages. All rights relating to patent, utility model or design registration reserved.

### **1.3 Storage**

The documentation forms an integral part of the frequency inverter. It must be stored such that it is accessible to operating staff at all times. If the frequency inverter is sold on to other users, then the documentation must also be handed over.

## 2 General safety instructions and information on use

The chapter "General safety instructions and information on use" contains general safety instructions for the Operator and the Operating Staff. At the beginning of certain main chapters, some safety instructions are included which apply to all work described in the relevant chapter. Special work-specific safety instructions are provided before each safety-relevant work step.

### 2.1 Terminology

According to the documentation, different activities must be performed by certain persons with certain qualifications.

The groups of persons with the required qualification are defined as follows:

#### **Operator**

This is the entrepreneur/company who/which operates the frequency inverter and uses it as per the specifications or has it operated by qualified and instructed staff.

#### **Operating staff**

The term Operating Staff covers persons instructed by the Operator of the frequency inverter and assigned the task of operating the frequency inverter.

**Skilled Personnel** The term **Skilled Personnel** covers staff that are assigned special tasks by the Operator of the frequency inverter, e.g. installation, maintenance and service/repair and troubleshooting. Based on their qualification and/or know-how, **Skilled Personnel** must be capable of identifying defects and assessing functions.

#### **Qualified electrician**

The term Qualified Electrician covers qualified and trained staff that has special technical know-how and experience with electrical installations. In addition, Qualified Electricians must be familiar with the applicable standards and regulations, they must be able to assess the assigned tasks properly and identify and eliminate potential hazards.

#### **Instructed person**

The term Instructed Person covers staff that was instructed and trained about/in the assigned tasks and the potential hazards that might result from inappropriate behavior. In addition, instructed persons must have been instructed in the required protection provisions, protective measures, the applicable directives, accident prevention regulations as well as the operating conditions and verified their qualification.

#### **Expert**

The term Expert covers qualified and trained staff that has special technical know-how and experience relating to the frequency inverter. Experts must be familiar with the applicable government work safety directives, accident prevention regulations, guidelines and generally accepted rules of technology in order to assess the operationally safe condition of the frequency inverter.

### 2.2 Designated use

The frequency inverter is designed according to the state of the art and recognized safety regulations.

The frequency inverters are electrical drive components intended for installation in industrial plants or machines. Commissioning and start of operation is not allowed until it has been verified that the machine meets the requirements of the EC Machinery Directive 2006/42/EC and DIN EN 60204-1.

The frequency inverters meet the requirements of the low voltage directive 2014/35/EU and DIN EN 61800-5-1. CE-labelling is based on these standards. Responsibility for compliance with the EMC Directive 2014/30/EU lies with the operator. Frequency inverters are only available at specialized dealers and are exclusively intended for commercial use as per EN 61000-3-2.

No capacitive loads may be connected to the frequency inverter.

The technical data, connection specifications and information on ambient conditions are indicated on the rating plate and in the documentation and must be complied with in any case.

### **2.3 Misuse**

Any use other than that described in "Designated use" shall not be permissible and shall be considered as misuse.

For, example, the machine/plant must not be operated

- by uninstructed staff,
- while it is not in perfect condition,
- without protection enclosure (e.g. covers),
- without safety equipment or with safety equipment deactivated,
- when general requirements, such as operating conditions and technical data, are not met.

The manufacturer shall not be held liable for any damage resulting from such misuse. The sole risk shall be borne by the operator.

### **Explosion protection**

The frequency inverter is an IP 20 ingress protection rating device. For this reason, use of the device in explosive atmospheres is not permitted.

### **2.4 Residual risks**

Residual risks are special hazards involved in handling of the frequency inverter which cannot be eliminated despite the safety-compliant design of the device. Residual risks are not obviously identifiable and can be a potential source of injury or a health hazard.

Typical residual hazards include:

#### **Electrical hazard**

Danger of contact with energized components due to a defect, opened covers or enclosures or improper working on electrical equipment.

Danger of contact with energized components in frequency inverter if no external disconnection device was installed by the operator.

During operation, all covers must be installed correctly, and all electrical cabinet doors must be closed to minimize electrical hazards.

#### **Electrostatic charging**

Touching electronic components bears the risk of electrostatic discharges.

#### **Thermal hazards**

Risk of accidents by hot machine/plant surfaces, e.g. heat sink, transformer, fuse or sine filter.

#### **Charged capacitors in DC link**

The DC link may have dangerous voltage levels even up to three minutes after shutdown.

#### **Danger of equipment falling down/over, e.g. during transport**

Center of gravity is not the middle of the electric cabinet modules.



## 2.5 Safety and warning signs on the frequency inverter

- Comply with all safety instructions and danger information provided on the frequency inverter.
- Safety information and warnings on the frequency inverter must not be removed.

## 2.6 Warning information and symbols used in the user manual

### 2.6.1 Hazard classes

The following hazard identifications and symbols are used to mark particularly important information:



#### DANGER

Identification of immediate threat holding a **high** risk of death or serious injury if not avoided.



#### WARNING

Identification of immediate threat holding a **medium** risk of death or serious injury if not avoided.







#### CAUTION

Identification of immediate threat holding a **low** risk of minor or moderate physical injury if not avoided.


#### NOTICE

Identification of a threat holding a risk of material damage if not avoided.


### 2.6.2 Hazard symbols

Symbol	Meaning	Symbol	Meaning
	General hazard		Suspended load
	Electrical voltage		Hot surfaces


### 2.6.3 Prohibition signs

Symbol	Meaning
	No switching; it is forbidden to switch the machine/plant, assembly on


### 2.6.4 Personal safety equipment

Symbol	Meaning
	Wear body protection


## 2.6.5 Recycling

Symbol	Meaning
	Recycling, to avoid waste, collect all materials for reuse


## 2.6.6 Grounding symbol

Symbol	Meaning
	Ground connection

## 2.6.7 ESD symbol

Symbol	Meaning
	ESD: Electrostatic Discharge (can damage components and assemblies)

## 2.6.8 Information signs

Symbol	Meaning
	Tips and information making using the frequency inverter easier.

## Font style in documentation

Example	Font style	Use
<b>1234</b>	bold	Representation of object numbers
<i>Object</i>	italic, Font Times New Roman	Representation of object names
<b>P.1234</b>	bold	Representation of object numbers without name, e.g. in formulas
<b>Q.1234</b>	bold	Representation of source numbers
01234	Courier new	Representation of firmware object values / object settings

## 2.7 Directives and guidelines to be adhered to by the operator

The operator must follow the following directives and regulations:

- Ensure that the applicable workplace-related accident prevention regulations as well as other applicable national regulation are accessible to the staff.
- An authorized person must ensure, before using the frequency inverter, that the device is used in compliance with its designated use and that all safety requirements are met.
- Additionally, comply with the applicable laws, regulations and directives of the country in which the frequency inverter is used.
- Any additional guidelines and directives that may be required additionally shall be defined by the operator of the machine/plant considering the operating environment.

## 2.8 Operator's general plant documentation

- In addition to the user manual, the operator should issue separate internal operating instructions for the frequency inverter. The Operating Instructions of the frequency inverter must be included in the user manual of the whole plant.

## **2.9 Operator's/operating staff's responsibilities**

### **2.9.1 Selection and qualification of staff**

- Any work on the frequency inverter may only be carried out by qualified technical staff. The staff must not be under the influence of any drugs. Note the minimum age required by law. Define the staff's responsibility in connection with all work on the frequency inverter clearly.
- Work on the electrical components may only be performed by a qualified electrician according to the applicable rules of electrical engineering.
- The operating staff must be trained for the relevant work to be performed.

### **2.9.2 General work safety**

- In addition to the user manual of the machine/plant, any applicable legal or other regulations relating to accident prevention and environmental protection must be complied with. The staff must be instructed accordingly. Such regulations and/or requirements may include, for example, handling of hazardous media and materials or provision/use of personal protective equipment.
- In addition to this user manual, issue any additional directives that may be required to meet specific operating requirements, including supervision and reporting requirements, e.g. directives relating to work organization, workflow and employed staff.
- Unless approved of expressly by the manufacturer, do not modify the frequency inverter in any way, including addition of attachments or retrofits.
- Only use the frequency inverter if the rated connection and setup values specified by the manufacturer are met.
- Provide appropriate tools as may be required for performing all work on the frequency inverter properly.

## **2.10 Organizational measures**

### **2.10.1 General**

- Train your staff in the handling and use of the frequency inverter and the machine/plant as well as the risks involved.
- Use of any individual parts or components of the frequency inverter in other parts of the operator's machine/plant is prohibited.
- Optional components for the frequency inverter must be used in accordance with their designated use and in compliance with the relevant documentation.

### **2.10.2 Use in combination with third-party products**

- Please note that BONFIGLIOLI GmbH will not accept any responsibility for compatibility with third-party products (e.g. motors, cables or filters).
- In order to enable optimum system compatibility, BONFIGLIOLI GmbH office components facilitating commissioning and providing optimum synchronization of the machine/plant parts in operation.
- If you use the frequency inverter in combination with third-party products, you do this at your own risk.

### **2.10.3 Transport and storage**

- The frequency inverters must be transported and stored in an appropriate way. During transport and storage the devices must remain in their original packaging.
- The units may only be stored in dry rooms which are protected against dust and moisture and are exposed to small temperature deviations only. The requirements of DIN EN 60721-3-1 for storage, DIN EN 60721-3-2 for transport and labeling on the packaging must be met.

- The duration of storage without connection to the permissible nominal voltage may not exceed one year.

#### **2.10.4 Handling and installation**

- Do not commission any damaged or destroyed components.
- Prevent any mechanical overloading of the frequency inverter. Do not bend any components and never change the isolation distances.
- Do not touch any electronic construction elements and contacts. The frequency inverter is equipped with components which are sensitive to electrostatic energy and can be damaged if handled improperly. Any use of damaged or destroyed components will endanger the machine/plant safety and shall be considered as a non-compliance with the applicable standards.
- Only install the frequency inverter in a suitable operating environment. The frequency inverter is exclusively designed for installation in industrial environments.
- If seals are removed from the case, this can result in the warranty becoming null and void.

#### **2.10.5 Electrical connections**

- The five safety rules must be complied with.
- Never touch live terminals. The DC link may have dangerous voltage levels even up to three minutes after shutdown.
- When performing any work on/with the frequency inverter, always comply with the applicable national and international regulations/laws on work on electrical equipment/plants of the country in which the frequency inverter is used.
- The cables connected to the frequency inverters may not be subjected to high-voltage insulation tests unless appropriate circuitry measures are taken before.
- Only connect the frequency inverter to suitable supply mains.

##### **The five safety rules**

When working on/in electrical plants, always follow the five safety rules:

- 1 Isolate
- 2 Secure to prevent restarting
- 3 Check isolation
- 4 Earth and short-circuit,
- 5 Cover or shield neighboring live parts.

#### **2.10.6 Safe operation**

- During operation of the frequency inverter, always comply with the applicable national and international regulations/laws on work on electrical equipment/plants.
- Before commissioning and the start of the operation, make sure to fix all covers and check the terminals. Check the additional monitoring and protective devices according to the applicable national and international safety directives.
- During operation, never open the machine/plant
- Do not connect/disconnect any components/equipment during operation.
- The machine/plant holds high voltage levels during operation, is equipped with rotating parts (fan) and has hot surfaces. Any unauthorized removal of covers, improper use, wrong installation or operation may result in serious injuries or material damage.
- Some components, e.g. the heat sink or brake resistor, may be hot even some time after the machine/plant was shut down. Don't touch any surfaces directly after shutdown. Wear safety gloves where necessary.
- The frequency inverter may hold dangerous voltage levels until the capacitor in the DC link is discharged. Wait for at least 3 minutes after shutdown before starting electrical or mechanical work on the frequency inverter. Even after this waiting time, make sure that

the equipment is deenergized in accordance with the safety rules before starting the work.

- In order to avoid accidents or damage, only qualified staff and electricians may carry out the work such as installation, commissioning or setup.
- In the case of a defect of terminals and/or cables, immediately disconnect the frequency inverter from mains supply.
- Persons not familiar with the operation of frequency inverters must not have access to the frequency inverter. Do not bypass nor decommission any protective facilities.
- The frequency inverter may be connected to power supply every 60 s. This must be considered when operating a mains contactor in jog operation mode. For commissioning or after an emergency stop, a non-recurrent, direct restart is permissible.
- After a failure and restoration of the power supply, the motor may start unexpectedly if the Auto Start function is activated.

If staff are endangered, a restart of the motor must be prevented by means of external circuitry.

- Before commissioning and the start of the operation, make sure to fix all covers and check the terminals. Check the additional monitoring and protective devices according to EN 60204 and applicable the safety directives (e.g. Working Machines Act or Accident Prevention Directives).

### 2.10.7 Maintenance and service/troubleshooting

- Visually inspect the frequency inverter when carrying out the required maintenance work and inspections at the machine/plant.
- Perform the maintenance work and inspections prescribed for the machine carefully, including the specifications on parts/equipment replacement.
- Work on the electrical components may only be performed by a qualified electrician according to the applicable rules of electrical engineering. Only use original spare parts.
- Unauthorized opening and improper interventions in the machine/plant can lead to personal injury or material damage. Repairs on the frequency inverters may only be carried out by the manufacturer or persons authorized by the manufacturer. Check protective equipment regularly.
- Before performing any maintenance work, the machine/plant must be disconnected from mains supply and secured against restarting. The five safety rules must be complied with.

### 2.10.8 Final decommissioning

Unless separate return or disposal agreements were made, recycle the disassembled frequency inverter components:

- Scrap metal materials
- Recycle plastic elements
- Sort and dispose of other component materials



Electric scrap, electronic components, lubricants and other utility materials must be treated as special waste and may only be disposed of by specialized companies.



Always comply with any applicable national disposal regulations as regards environmentally compatible disposal of the frequency inverter. For more details, contact the competent local authorities.

After the end of product service life, the user/operator must take the device out of operation.

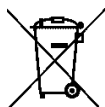


For more information about the decommissioning of the device refer to the applicable operating instructions document.

**Disposal requirements under European Union WEEE regulations**

The product is marked with the WEEE symbol shown below.

This product cannot be disposed as general household waste. Users responsible for the final disposal must make sure that it is carried out in accordance with the European Directive 2012/19/EU, where required, as well as the relative national transposition rules. Fulfil disposal also in according with any other legislation in force in the country.



### 3 Introduction


The CANopen® based standard DS402 “drives and motion control” describes and defines the necessary objects and functions for motion control systems.

The CANopen® standard DS301 describes the basic communication functions in principle. This chapter will give a short overview of the various functions based on DS301. Detailed information on the CAN physical layer and CANopen® DS301 functions can be found in the respective literature and in standards published by CAN-in-Automation CiA® ([www.can-cia.org](http://www.can-cia.org)).

The present document describes the possibilities and properties of CAN communication for the frequency inverters of the AXIA series.



This manual does not intend to provide general/basic information on the CAN bus.

In this document, the hardware circuitry, relevant objects and the available objects are described as pertains to the CMA-CAN module. For further communication setup options  the operating instructions document.

The functions and objects are described in this manual to the extent necessary. For further information, reference is made here to the CiA® Standards.

The available objects are sub-divided as follows:

- Communication objects   **(0x1nnn)**
- Manufacturer objects   **(0x2nnn - 0x5nnn)**
- Standardized objects   **(0x6nnn)**

The standards referred to are available at:

**CiA, CAN in AUTOMATION**

**Am Weichselgarten 26**

**Tel.: +49 9131 69086-0**

**D-91058 Erlangen**

**Fax: +49 9131 69086-79**

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#### NOTICE

With the communication module, it is possible in principle to access **ALL** frequency inverter's objects via a controller. There are access restrictions via user management within the software. Changing object values, the functions of which are not known to the user, can result in unintended movements and material and/or personal losses as well as inoperativeness of the frequency inverter. Be cautious, if the function of a particular object is not fully clear to you.



For operation with a controller, an Electronic Data Sheet (EDS) File is required. It describes functions and properties of the inverter in a standardized manner. The latest device description can be downloaded from the [Bonfiglioli.com](http://Bonfiglioli.com) website.

Hexadecimal values are marked in the following by a preceding “0x”.

#### Software

AXIA Manager is the software for configuration and maintenance of BONFIGLIOLI frequency inverters. It can connect with a frequency inverter while it is communicating with a PLC. To run the AXIA Manager you require a computer/PC, running on a Windows OS. The manufacturer also provides an iOS and an Android app version of the AXIA Manager, with less functionalities than in the Windows software.

Using the AXIA Manager you can configure and manage objects relevant for the communication module.

## 4 Installation/Disassembly of the communication module

The CMA-CAN-01 communication module is delivered in a separate case ready for assembly.

### 4.1 Installation

#### CAUTION!

##### Destroying inverter and/or communication module

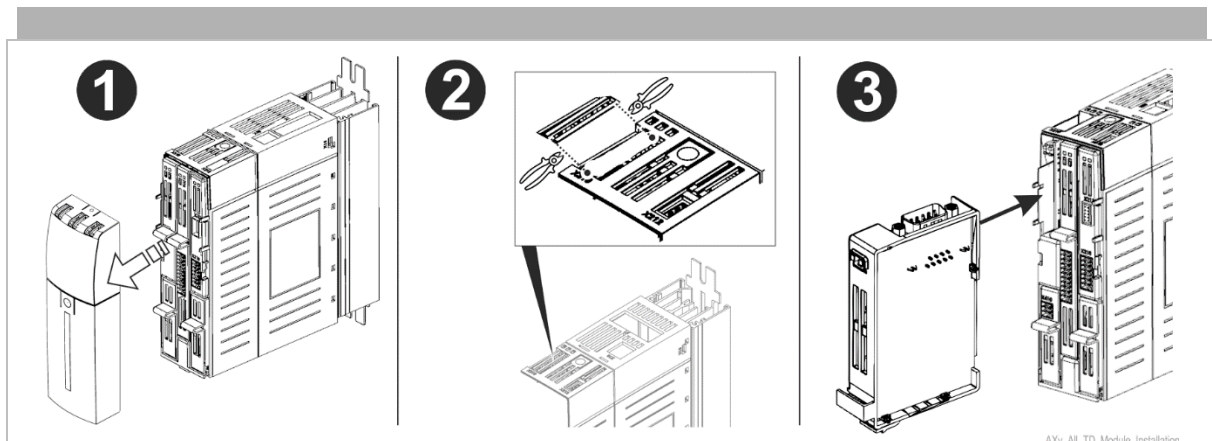
Connecting / disconnecting the module while the inverter is connected to live voltage can destroy the module and/or the inverter.



- Disconnect the frequency inverter from the power supply before installation of the communication module. Assembly under live voltage is not permissible.
- Do not touch the PCB visible on the back of the module, otherwise components may be damaged.

#### Work steps:

- Disconnect the frequency inverter from the mains voltage and protect it against being energized unintentionally.
- Disconnect the frequency inverter from the external 24 V if used and protect it against being energized unintentionally.

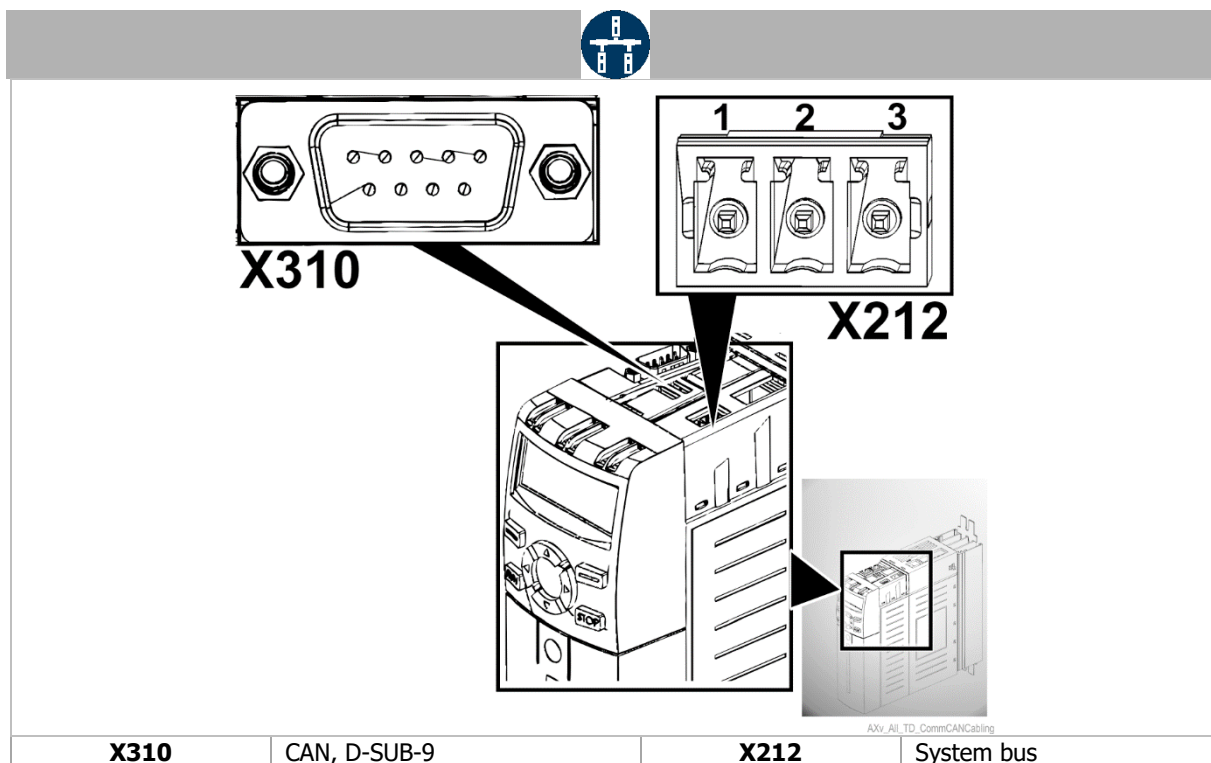


1. Remove covers of the frequency inverter. The upper left slot for the communication module is now accessible.
2. In the upper cover, break out the pre-punched cut-out for the interface X310, if necessary.
3. Insert the communication module into the slot until it engages audibly.



### 4.1.1 Connector Assignment

The CMA-CAN-01 module uses 9-pin D-Sub connectors.



#### Technical characteristics: System bus interface X212

Raster width 3.81 mm

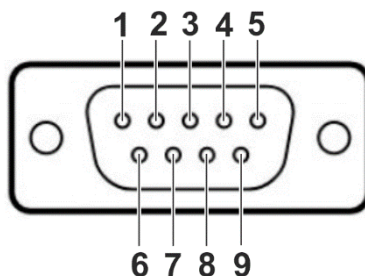
S213 (on/off) located behind the X212 terminal. (front ← off / on → back)

#### X212 System bus: Connector assignment

Terminal	Description
X212.1	CAN_High
X212.2	CAN_Low
X212.3	GND

The cable length is restricted by the BAUD rate, cables must not exceed a length of 100 m.

#### Technical characteristics: CAN bus interface X310





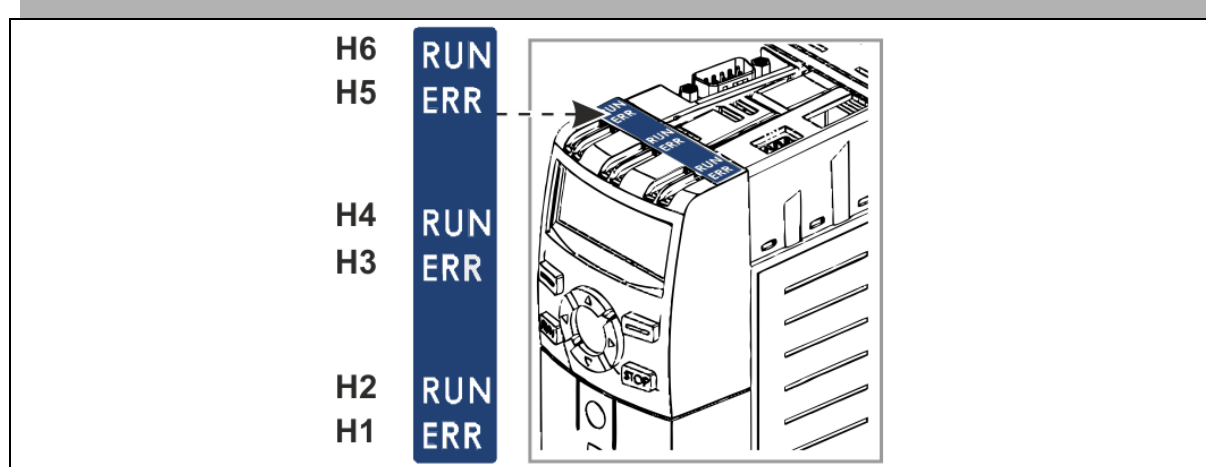
### 4.1.3 Status LEDs

#### NOTICE

##### Residual risk

LEDs and other indicating elements on the frequency inverter not displaying anything does not mean that the device is deenergized.

- Before carrying out any work with the device, where contact with energized parts might be possible, always check if the device is deenergized, irrespective of the status of any indicating elements.
- Make sure the adhesive label has been placed correctly according to CEMA leaflet included in the scope of supply.



#### Status output via communication module LEDs:

The front LEDs (H5, H6) indicate the current status of the corresponding port of the communication module.

LED	ON	OFF	FLASHING
ON		The device is operating correctly.	
OFF	Non-acknowledgeable error	Reset or no voltage	Acknowledgeable error
FLASHING		The device has not been configured.	The device is performing its power-up testing.

### 4.2 Disassembly

- Disconnect the frequency inverter from mains voltage and external 24 V and protect it against being energized unintentionally.
- Remove covers of the frequency inverter, if necessary.
- Disconnect/unplug any connected lines.
- Unplug the communication module from its slot by unlocking the locking hooks on the right- and left-hand side of the module from the case of the frequency inverter using a small screwdriver.
- Proceed carefully to not damage the module.

## 5 Baud rate setting/line lengths

The transmission speed of the CANopen® communication module CM-CAN can be set via the object *CANopen Baudrate* **0x3911/2**.

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
3911	2	CANopen Baudrate	Unsigned32	r/w	No	1000

The transmission rate is a function of a variety of application-specific objects. The line length of the communication network limits the transmission speed due to the signal propagation time of the CANopen® protocols.

CANopen® interface		
Operation mode	Function	max. Line length
50 kBaud	Transmission rate 50 kBaud	1000 meters
100 kBaud	Transmission rate 100 kBaud	500 meters
125 kBaud	Transmission rate 125 kBaud	500 meters
250 kBaud	Transmission rate 250 kBaud	250 meters
500 kBaud	Transmission rate 500 kBaud	100 meters
800 kBaud	Transmission rate 800 kBaud	50 meters
1000 kBaud	Transmission rate 1000 kBaud	25 meters

## 6 Setting the node address

The CANopen® protocol supports a maximum of 127 nodes in a communication network. Each frequency inverter is assigned a node ID, which may only exist once in the system, for its unambiguous identification. The node number is set with object *CANopen Node ID* **0x3911/1**.

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
3911	1	CANopen Node ID	Unsigned32	r/w	No	0

Object		Setting		
No.	Description	Min.	Max.	Fact. sett.
0x3911/1	CANopen Node ID	0	127	0




The factory setting *CANopen Node ID* **0x3911/1** = 0 means that the CANopen® interface has been **deactivated**.



Changing the node number causes a restart of the CANopen® system (NOT a reset of the inverter).

## 7 Operating behavior in the case of bus connection failure

The required behavior can be set via the object **0x6007** *Abort conn. option code* .  the operating instructions document for more details.

## 8 CANopen Overview

Every CANopen® device contains an object dictionary with all supported objects. The objects can be divided into the two main groups – communication objects and application objects. The objects are addressed by their index **0xnnnn** (16 bit) and sub-index **0xnn** (8 bit).

The different functions defined by CANopen® (NMT, SDO, SYNC, PDO, Emergency) use fixed identifier ranges. These identifier ranges are defined by the “Predefined Connection Set”. By default every function uses an identifier calculated as the base number plus node-ID (node-ID set by object *CANopen Node ID* **0x3911/1**).

### 8.1 Communication Objects

The communication objects are located in the index range **0x1nnn**. They describe the communication behavior of a CANopen® device. Some of the communication objects comprise device information (e. g. manufacturer’s vendor-id or inverter serial number). With the help of communication objects the application objects for device control are mapped to the PDO messages.

### 8.2 Application Objects

Application objects are divided in two groups. Index range **0x2000** to **0x5FFF** is reserved for manufacturer-specific objects, and index range **0x6nnn** is reserved for specific device profile objects. The specific device profile objects **0x6nnn** are defined by CANopen® DS402 “drive and motion control”. They are used for controlling device functions (Start/Stop, speed, positioning functions).

### 8.3 SDO Function

The SDO (Service Data Objects) messages are used for reading and writing the objects located in the object dictionary. Objects with up to four bytes of data are transferred with an expedited SDO transfer that uses one request and one response message. Access to objects with more than four bytes of data is accomplished by a segmented domain transfer.

In the following chapters, the necessary messages for reading/writing objects with expedited transfer are described in detail. Access to communication, manufacturer and device profile specific objects with up to four bytes of data is accomplished in the same way. The only difference is in the index and sub-index number.

The inverter supports one server SDO. This server SDO is accessed by the client SDO on the PLC side. An SDO message always has a COB-ID followed by 8 data bytes.

#### SDO-message:

COB-ID	0	1	2	3	4	5	6	7
COB-ID	command specifier (cs)	index		sub-index	data	data	data	data
	nn	LSB	MSB					

Default Identifiers (COB-ID):

TxSDO            0x600 (=1536) + Node-ID

RxSDO            0x580 (=1408) + Node-ID

Depending on the transfer direction and the number of data bytes, different command specifiers are used.

The error codes of failed SDO accesses  8.3.3.

#### 8.3.1 Read Access

##### Client → Server, Upload Request

COB-ID	0	1	2	3	4	5	6	7
0x600 + Node-ID	cs	index		sub- index	data	data	data	data
	<b>0x40</b>	LSB	MSB		00	00	00	00

### Server → Client, Upload Response

COB-ID	0	1	2	3	4	5	6	7
0x580 + Node-ID	cs	index		sub- index	data	data	data	data
	<b>0x4x</b>	LSB	MSB		data01	data02	data03	data04

The number of valid data bytes is coded in the response of the command specifier.

Number of data bytes	1	2	3	4
Command specifier (cs)	0x4F	0x4B	0x47	0x43

### 8.3.2 Write Access

#### Client → Server, Download Request

COB-ID	0	1	2	3	4	5	6	7
0x600 + Node-ID	cs	index		sub- index	data	data	data	data
	<b>0x2x</b>	LSB	MSB		data01	data02	data03	data04

#### Server → Client, Download Response

COB-ID	0	1	2	3	4	5	6	7
0x580 + Node-ID	cs	index		sub- index	data	data	data	data
	<b>0x60</b>	LSB	MSB		00	00	00	00

The number of valid data bytes must be coded in the request of the command specifier.

Number of data bytes	1	2	3	4
Command specifier	0x2F	0x2B	0x27	0x23

#### NOTICE

Using Write accesses for objects (objects 0x2nnn = index), the sub-index is used to define the Write access into RAM.

### 8.3.3 Error code table

If an error occurs in reading or writing, the server SDO of the frequency inverter replies with the SDO abort message. This message contains the index/subindex and appropriate error code.

#### Server → Client Abort SDO Transfer

COB-ID	0	1	2	3	4	5	6	7
0x580 + Node-ID	cs	index		sub- index	abort code low		abort code high	
	<b>0x80</b>	LSB	MSB	LSB	MSB	LSB	MSB	LSB

Error codes			
Abort code high	Abort code low	Description to CANopen®	Product-specific allocation
0x0504	0x0000	SDO protocol timed out	SDO access Time Out
0x0601	0x0000	Unsupported access to an object	Object cannot be written or read
0x0602	0x0000	Object does not exist	Object does not exist
0x0604	0x0047	General internal incompatibility in the device	Data sets differ
0x0606	0x0000	Access failed due to a hardware error	EEPROM Error (Read/write/checksum)
0x0607	0x0010	Data type does not match	Object has a different data type
0x0607	0x0012	Data type does not match or length of Service telegram too big	Object has a different data type or telegram length not correct.
0x0607	0x0013	Data type does not match or length of Service telegram too small	Object has a different data type or telegram length not correct.
0x0609	0x0011	Subindex does not exist	Data set does not exist
0x0609	0x0030	Value range of object exceeded	Object value too large or too small
0x0609	0x0031	Value of object written too high.	Object value too large
0x0609	0x0032	Value of object written too low.	Object value too small
0x0800	0x0020	Data cannot be transmitted or saved	Invalid value for operation
0x0800	0x0021	Data cannot be transferred because of local control	Object cannot be written in operation

### 8.3.4 Segmented Transfer

For data lengths > 4 Bytes the so-called Segmented Transfer is used – the expedited Transfer only supports lengths up to 4 Bytes.

In the first "Initiate" telegram, the overall amount of used data of the following sequence telegrams is defined.

In the following telegrams 7 data bytes per telegram are send until the number of data bytes to be transmitted was reached. The sequences of the Segmented Transfer are separated by a toggle bit in the command specifier for the request and the reply telegram. A "Continue" Bit marks the last telegram.

#### 8.3.4.1 Reading „Segmented Transfer“

When Reading a regular Read access via command specifier 0x40 is executed. The response contains the command specifier 0x41 that marks the requirement of Segmented Transfer for this object. The following requests alternate with command specifiers 0x60 and 0x70 until all data bytes were transmitted. In the last segment the command specifier (bits 1...3) contains the number of not used data bytes in that last segment.

The resulting request and response telegrams are shown in the following sequence.

The Command Specifier has the following setup:

#### Initiate Upload Command Specifier:

<b>Request:</b>	Bit	7	6	5	4	3	2	1	0	
		ccs			0	0	0	0	0	
<b>Response:</b>	Bit	7	6	5	4	3	2	1	0	
		scs			0	n		e	s	

#### Segment Upload Command Specifier:

<b>Request:</b>	Bit	7	6	5	4	3	2	1	0	
		ccs			t	0	0	0	0	
<b>Response:</b>	Bit	7	6	5	4	3	2	1	0	
		scs			t	n			c	

Abbreviation	Description	Values
ccs	Client command specifier	2 = Initiate upload request 3 = Upload segment request
scs	Server command specifier	2 = Initiate upload response 0 = Upload segment response
n	Only valid if e =1 AND s = 1, in all other cases n = 0.	If valid: Number of data bytes, that contain no useful data
e	Transfer type	0 = Normal (Segmented) transfer 1 = Expedited Transfer (see chapter 8.3.1)
s	Size indicator	0 = Data frame size is displayed 1 = Data frame size is not displayed
t	Toggle bit, toggled with each segment change	0 = First and odd segments 1 = Second and even segments
c	Continue bit, marks following segments	0 = Further segments follow. 1 = This was the last segment.

The following sequence of telegrams results:

### Initiate SDO Upload

		COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Index		Sub-idx	Data			
			<b>0x40</b>	LSB	MSB		00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Index		Sub-idx	Data			
			<b>0x41</b>	LSB	MSB		LSB	...	...	MSB

### Segment Upload, first and odd segments

		COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Data						
			<b>0x60</b>	00	00	00	00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Data						
			<b>0x00</b>	LSB	...	...	...	...	...	MSB

### Segment Upload, second and even segments

		COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Data						
			<b>0x70</b>	00	00	00	00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Data						
			<b>0x10</b>	LSB	...	...	...	...	...	MSB

### Segment Upload, last segment

		COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Data						
			<b>0x60 or 0x70</b>	00	00	00	00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Data						
			<b>0xnn</b>	LSB	...	...	...	...	...	MSB

#### 8.3.4.2 Writing Segmented Transfer

The first telegram to write is executed via Command Specifier 0x21. The number of entered data bytes in the data area defines the number of data bytes to be transmitted in the following segment transfers. The following segments are controlled via Command Specifier 0x00 and 0x10 in toggling order until all data were transmitted. The last segment contains in the Command specifier (Bit 1...3) the number of not used data bytes in the last telegram.

The resulting request and response telegrams are shown in the following sequence.

The Command Specifier has the following setup:



### Initiate Download Command Specifier:

Request:	Bit	7	6	5	4	3	2	1	0	
		CCS			0	n		e	s	
Response:	Bit	7	6	5	4	3	2	1	0	
		SCS			0					

### Download SDO Segment Command Specifier:

<b>Request:</b>	Bit	7	6	5	4	3	2	1	0	
		CCS			t	n			c	
<b>Response:</b>	Bit	7	6	5	4	3	2	1	0	
		SCS			t	0	0	0	0	

Abbreviation	Description	Values
ccs	Client command Specifier	1 = Initiate download request 0 = Download sequence request
scs	Server command Specifier	3 = Initiate download request 1 = Download sequence response
n	Only valid if e = 1 AND s = 1, in all other cases n = 0.	If valid: Number of data bytes, that contain no useful data
e	Transfer type	0 = Normal Transfer 1 = Expedited Transfer (see chapter 8.3.2)
s	Size indicator	0 = Data frame size is displayed 1 = Data frame size is not displayed
t	Toggle bit, toggled with each Segment change	0 = First and odd segments 1 = Second and even segments
c	Continue bit, marks following segments	0 = Further segments follow. 1 = This was the last segment.

## Initiate SDO Upload

	COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Index		Sub-idx	Data		
			<b>0x21</b>	LSB	MSB		LSB	...	MSB
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Index		Sub-idx	Data		
			<b>0x41</b>	LSB	MSB		00	00	00

## Segment Upload, first and odd segments

	COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Data					
			<b>0x00</b>	00	00	00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Data					
			<b>0x20</b>	00	00	00	00	00	00

## Segment Upload, second and even segments

	COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Data					
			<b>0x10</b>	00	00	00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Data					
			<b>0x30</b>	00	00	00	00	00	00

## Segment Upload, last segment

	COB-ID	0	1	2	3	4	5	6	7
<b>Request</b>	Client → Server	0x600 + Node-ID	cs	Data					
			<b>0xnn</b>	00	00	00	00	00	00
<b>Response</b>	Server → Client	0x580 + Node-ID	cs	Data					
			<b>0x10 or 0x20</b>	LSB	...	...	...	...	MSB

## 8.4 PDO Function

PDO (Process Data Objects) messages contain up to 8 bytes of process data. Using communication objects (communication/mapping objects) the process data objects are mapped to Rx/Tx-PDOs. The frequency inverters support three RxPDOs (PLC → frequency inverter) and three TxPDOs (frequency inverter → PLC).

Process data objects are linked directly to the functions of the frequency inverter.

### PDO-message:

Byte	0	1	2	3	4	5	6	7
	data	data	data	data	data	data	data	data

### PDO identifier:

The number of bytes is 1 ... 8 and it depends on the mapped objects. The bytes are arranged in the Intel format.

Byte	0	1	2	3	4	5
	16-bit object		32-bit object			
	LSB	MSB	LSB	...	...	MSB

Prior to setting a new ID the last ID has to be deactivated by 0x80000000.

## Default Identifiers:

Decimal	Hexadecimal
TxPDO1 384 + Node-ID	0x180 + Node-ID
RxPDO1 512 + Node-ID	0x200 + Node-ID
TxPDO2 640 + Node-ID	0x280 + Node-ID
RxPDO2 798 + Node-ID	0x300 + Node-ID
TxPDO3 896 + Node-ID	0x380 + Node-ID
RxPDO3 1024 + Node-ID	0x400 + Node-ID

The PDO identifiers can be configured via the objects **140n/0** or **180n/0**. (☞ 9.1.2.19 and 9.1.2.21)

## 8.5 Emergency Function

If there is a communication error or an error in the frequency inverter, the frequency inverter will send an error message. The error message contains the relevant error information. Once the error is acknowledged (error reset), an error message is sent, with the data bytes reset to zero. (☞ 9.1.2.13)

COB-ID EMCY	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x80 (=128) + Node-ID	EEC	EEC	ER	Axis	Axia Fault	No.	0	0

EEC: Emergency Error Code according to DS301

ER: Emergency Register Code according to DS301

## 8.6 CAN-Systembus SYNC

If an Axia inverter synchronizes to a PLC via the CMA module the CAN-Systembus SYNC functionality can be activated. In this special situation the SYNC telegrams triggered by CAN-Systembus SYNC are synchronized to the PLC while those inverters that are not connected to PLC by their CMA board are able to synchronize as CAN-Systembus SYNC slave. This method works only with Systembus. If a field bus other than Systembus is active, CANopen will not be able to activate, as the internal administration structures will be already occupied.

The SYNC message has two meanings. The SYNC message is necessary for Rx/TxPDO with transmission type synchronous (☞ 9.1.2.19 and 9.1.2.21). The SYNC message synchronizes the different devices to communicate with data from the same (defined) time. As soon as the SYNC telegram is received, the data of all devices are "frozen" and then exchanged during the following data telegrams.

Axia inverters can synchronize its OS to different SYNC sources:

- CAN-Systembus
- CANopen
- EtherCAT
- Profinet IRT

The RxPDO telegrams are collected until a SYNC telegram is received. With the reception of the SYNC telegram, the data is transferred internally to the application objects.

TxPDOs defined as synchronous send the actual application data on SYNC reception.

Additionally, the SYNC mechanism can be used to synchronize the operating systems (OS) of different drives. This is useful when the electronic gear is used to enhance the performance of the application. For synchronization of the operating systems ☞ 8.10.

The SYNC message is a message without data or with one data byte. The default Identifier is 0x80 (=128).

COB-ID	Byte 0
0x80 (=128)	SYNC

This configuration can be adjusted via the Object **0x1005** *COB-ID SYNC message*. The value range for the COB-ID setting is defined in the DS301 standard. The lasting time of the SYNC cycle is defined in object **0x1006** *Comm cycle period*.



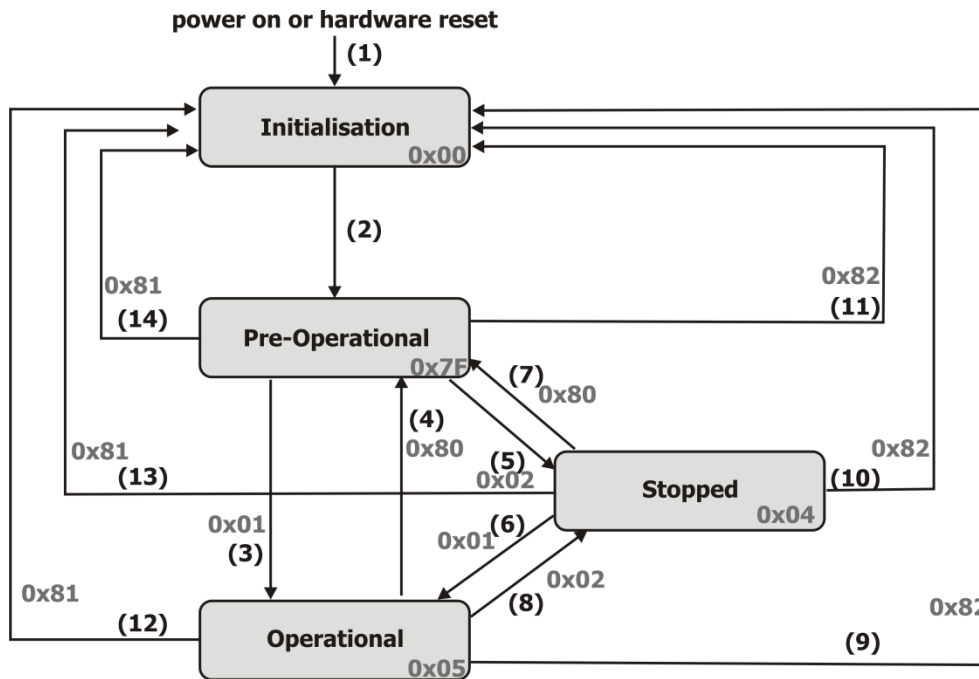
In case a CMA board with SYNC capability is plugged and SYNC is activated for the CMA board, it is NOT possible to synchronize an Axia inverter to CAN-Systembus. In this situation all inverters are synchronized to the PLC.

## 8.7 NMT Functions

The NMT (= Network Management) functions describe the NMT Statemachine and NMT error saving functions.

The NMT state machine is controlled by NMT commands. The error control functions "guarding" and "heartbeat" are set up by associated communication objects and controlled by special protocols.

### 8.7.1 NMT State Machine



A change of NMT-State may also be triggered by a communication (Bus-off, Guarding, etc.).

transition	NMT command
(1)	At power on NMT state Initialization is entered autonomously
(2)	NMT state Initialization finished → NMT state Pre-Operational entered automatically, device sends Boot-Up message
(3)	Start Remote Node
(4), (7)	Enter Pre-Operational
(5), (8)	Stop Remote Node
(6)	Start Remote Node
(9), (10), (11)	Reset Node. Communication objects 0x1nnn and application objects 0x6nnn are reset.
(12), (13), (14)	Reset Communication. Communication objects 0x1nnn are reset.


In state transition (2) Initialization → Pre-Operational the device sends the Boot-Up message.

### 8.7.2 Boot-Up message

Identifier	Byte 0
0x700 (=1792) + Node-ID	0

The Boot-Up message is sent automatically when the device is powered on or reset (i.e. fault reset). This helps the PLC recognizing to switch on a device (i.e. after a power failure and recovery) reliable during operation without Nodeguarding.

If the inverter is switched on after the PLC, the PLC can use this boot-up message to begin the initialization. The boot-up message signals the PLC, that the inverter is ready for the PLC to communicate. Using a NMT telegram "Reset Node" or "Reset Communication" forces a Reset of the node communication and results in a Boot-Up message.

Also  8.8 "Guarding".

### 8.7.3 NMT commands

	Byte 0	Byte 1	
Identifier	Command Specifier	Node-ID	
0	cs	id	

**id** = 0 command addressed to **all** devices

**id** = 1...0x7F (=127) command addressed to device with Node-ID = id

**cs:** 1 Start Remote Node

2 Stop Remote Node

0x80 (=128) Enter Pre-Operational

0x81 (=129) Reset Node

0x82 (=130) Reset Communication

#### NMT states and active communication objects:

	Pre-Operational	Operational	Stopped
PDO		<b>X</b>	
SDO	<b>X</b>	<b>X</b>	
SYNC	<b>X</b>	<b>X</b>	
Emergency	<b>X</b>	<b>X</b>	
Node control + NMT error control *	<b>X</b>	<b>X</b>	<b>X</b>

\* NMT commands + Guarding/Heartbeat function

## 8.8 Guarding

### Guarding response:

The inverter responds to every guarding request of the PLC. This is used by some PLCs to search for available devices when powering on. This response is done always independently of the settings of objects **0x100C** *Guard Time* and **0x100D** *Lifetime Factor*.

### Guarding activation:

The Guarding is set whenever objects **0x100C/0** *Guard Time* and **0x100D/0** *Lifetime Factor* are both unequal to zero. The resulting guarding time is *Guard Time x Lifetime Factor*. Guarding is activated after setting the objects and on reception of the first guarding request.

### Guarding fault behavior:

If the inverter does not receive a guarding request within the specified guarding time a guarding event is triggered. The inverter's reaction to this guarding event is defined by objects **0x6007** *abort connection option code* and **0x1029** *error behaviour*.

### Guarding sequence:

The PLC sends via a RTR (Remote Transmission Request) a guarding request with Identifier 0x700 + Node-ID (no data bytes). This remote frame is answered by the inverter with the same Identifier and one data byte. The data byte contains a toggle bit and the NMT state of the inverter.

### PLC:

Identifier

0x700 (=1792)+ Node-ID RTR

## Inverter:

Identifier	Byte 0							
	NMT state + toggle bit							
0x700 + Node-ID	7	6	5	4	3	2	1	0
	t	NMT state						

**t:** Toggle bit toggled on each transmission (first transmission t = 0)

<b>NMT state:</b>	0	Boot-Up
	4	Stopped
	5	Operational
	0x7F (=127)	Pre-Operational

## 8.9 Heartbeat



The functions Heartbeat and Guarding are mutually exclusive.

The heartbeat uses the producer/consumer method. The inverter as heartbeat consumer can monitor up to three heartbeat producers. The inverter can also send the heartbeat message (as heartbeat producer). The heartbeat contains the NMT state of the producer.

The heartbeat consumer function is set by object **0x1016** *Consumer Heartbeat Time*. After setting the object the Monitoring of the heartbeat message(s) starts with reception of the first heartbeat message.

If the inverter does not receive a producer heartbeat message within the specified consumer heartbeat time, a heartbeat event is triggered. The reaction to this heartbeat event is defined by objects **0x6007** *abort connection option code* and **0x1029** *error behaviour*.

The heartbeat producer function is set by object **0x1017** *Producer Heartbeat Time*. If object **0x1017** is set unequal to zero the inverter sends a heartbeat message periodically.

### Heartbeat message:

Identifier	Byte 0							
	NMT state							
0x700 (=1792) + Node-ID	7	6	5	4	3	2	1	0
	r	NMT state						

r: reserved (always 0)

<b>NMT state:</b>	0	Boot-Up
	4	Stopped
	5	Operational
	127	Pre-Operational

## 8.10 OS Synchronization

The operating system (OS) of the frequency inverter can be synchronized with a PLC or other device. Synchronization of the operating system will improve the operating characteristics of the machine. Synchronization is used to eliminate CPU **phase** shifting between master and slave devices to make sure that calculations are carried out at the same time. The synchronization time must be a natural number (multiple of 1 ms: in CANopen 1ms; in EtherCAT 125µs; in PROFINET IRT 250µs).

### Synchronization via CANopen:

When using CANopen® without Systembus, the synchronization can be switched on and off. Synchronization can be done with CANopen® SYNC telegrams.

### Synchronization via Systembus:

When using CANopen® simultaneously with Systembus, the synchronization can be set to either CANopen, Systembus or it can be switched off. Synchronization can be done with Systembus SYNC telegrams or Systembus RxPDO telegrams.

**Note:** When synchronizing the OS via CANopen®, the master has to support the synchronization mechanisms of CANopen®.

Sync Source 0x3906/14	
Operation mode	Function
0 - Off	The OS is not synchronized with other devices.
1 - Automatic	The synchronization source is selected automatically by the frequency inverter. <b>Factory setting.</b>
2 - CM Modul	The OS is synchronized via CM-Module.
3 - CANopen®	The OS is synchronized via CANopen®.
4 - Systembus	The OS is synchronized via System bus

CANopen® active	Systembus active	Synchronization
Yes	Yes	Synchronization via CANopen®
Yes	No	
No	Yes	Synchronization via Systembus
No	No	No Synchronization activated.

In the object **0x3906/15** *Active Sync Source* you can read the active sync source. The CANopen “active status for synchronization” is recognized by the object setting **0x3911/1** *CANopen Node ID* >0 and a running synchronous PDO.

## 8.11 Resetting errors

Depending on the settings and operating state of the device, errors can be reset in various ways:

When using control via object *Control Mode* **0x2200** = Statemachine:

- Set bit 7 in **0x6040** *Control word* = 0x0080.

When using control via Keypad, parameter *Control mode* **0x2200** = Keypad:

- Press the STOP button of the keypad.
- Resetting by pressing the STOP button is only possible if parameter *Control Mode* **0x2200** permits control via the keypad.

When using control via IOs, parameter *Control mode* **0x2200** = IOs:

- Reset the error by activating the corresponding digital input.
- Resetting via digital signal can only be carried out when parameter *Control Mode* **0x2200** permits this or when an input with the additional (hardware) is selected in the case of physical inputs.



Some errors will occur again after an error reset. In such cases, it may be necessary to take certain measures (e.g. moving from a limit switch in the non-disabled direction).

## 9 Objects

The available objects are marked with Index and Subindex and must be addressed via this ID. The objects are listed in the following tables. The following definitions apply:

Access type			
Read only	The PLC can only read data from the frequency inverter.		
Read/Write	The PLC is granted access (reading and writing) to the frequency inverter data.		
Data type			
Unsigned32	32 Bit value: (UDINT)	0...2 <sup>32</sup> -1 0...0xFFFF FFFF	(0...4294967295)
Unsigned16	16 Bit value: (UINT)	0...2 <sup>16</sup> -1 0...0x FFFF	(0...65535)
Unsigned8	8 Bit value: (USINT)	0...2 <sup>8</sup> -1 0...0xFF	(0...255)
Integer32	Signed 32 Bit value: (DINT)	-2 <sup>31</sup> ...2 <sup>31</sup> -1 0x8000 0000...0x7FFF FFFF	(-2147483648 ... 2147483647)
Integer16	Signed 16 Bit value: (INT)	2 <sup>15</sup> ...2 <sup>15</sup> -1 0x8000...0x7FFF	(-32768...32767)
Integer8	Signed 8 Bit value: (SINT)	2 <sup>7</sup> ...2 <sup>7</sup> -1 0x80...0x7F	(-128...127)
PDO Mapping			
No	This object cannot be used for exchange of PDO. Only SDO can be used.		
Tx	This object can be transmitted from the frequency inverter in a TxPDO.		
Rx	This object can be transmitted to the frequency inverter in a RxPDO.		



"Highest subindex supported" shows the highest subindex supported by the object.

### 9.1.1 Objects table

#### Object Grouping

Every object is addressed via a 16 Bit index, which is displayed as a 4-digit hexadecimal number. The object indexes are sorted in groups as follows:

<b>0x1000 – 0x1FFF</b>	DS301 Communication objects	
<b>0x2001 – 0x5FFF</b>	Bonfiglioli-specific objects can be subdivided in axis-dependent objects versus axis-independent objects. There is an offset of 0x0800 per axis in the axis-dependent range, see example below.	
	<b>0x2001 – 0x27FF</b>	Configuration of axis-dependent settings
	<b>0x3800 – 0x3FFF</b>	Configuration of axis-independent settings
	<b>0x4000 – 0x4FFF</b>	Actual values of axis-dependent readings
	<b>0x5800 – 0x5FFF</b>	Actual values of axis-independent readings
<b>0x6000 – 0x6FFF</b>	CiA402 Device Profile Objects	



For example:

**0x2001** *Motor Type* on Axis 1 and **0x2801** *Motor Type* on Axis 2.

Object-no		Group
from	to	
0x2001	0x27FF	Configuration: Axis 1, Settings for Axis 1 Example: 0x2001 for motor type Axis 1
0x2801	0x28FF	Configuration: Axis 2, Settings for Axis 2 Example: 0x2801 for motor type Axis 2
0x3800	0x3FFF	Configuration: Axis independent settings Example: 0x3801 for serial-no. of Axia device
0x4000	0x47FF	Actual Values: Readings for Axis 1 Example: 0x4001 for active dataset Axis1
0x4800	0x4FFF	Actual Values: Readings for Axis 2 Example: 0x4801 for active dataset Axis2
0x5800	0x5FFF	Actual Values: axis independent readings Example: 0x5801 for DC-link Voltage
0x6000	0x67FF	CiA 402 objects Axis 1
0x6800	0x6FFF	CiA 402 objects Axis 2

### 9.1.2 Communication Objects (0x1nnn)

Communication objects **0x1nnn** contain all objects for communication.

#### Abbreviations used

r/w: Read/Write  
ro: Read only  
wo: Write only  
Map: Mapping  
Def.-Val: Default value



The headings are displayed in the format *Index/Subindex Object name*.

#### 9.1.2.1 0x1000 Device Type

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1000	0	Device Type	Unsigned 32	ro	No	0

The device identification is carried out upon network startup. The information about the device type and functionality (type) is defined by the CANopen® DS402 standard.

Object 0x1000					
Additional Information				Device Profile Number	
Mode Bits		Type			
31	24	23	16	15	0

The standard device profile "Drives and Motion Control" used by the frequency inverter is shown as device profile number 402. The other information specifies the device functionality of the frequency inverter.

Device Profile Number = 402 drives and motion control  
Type = 0x41 Frequency inverter  
Mode bits = 0 unused

#### 9.1.2.2 0x1001 Error Register

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1001	0	Error Register	Unsigned 8	ro	No	0

Object **0x1001** is the error register for internal frequency inverter errors. Status "no error" (**0x1001** = 0) or "Error" (**0x1001** ≠ 0) is displayed.

In case of an error, the PLC can evaluate detailed information via the Emergency Message (☞ 8.5 "Emergency Function").

Object 0x1001/0			
Bit		Bit	
0	Generic error	4	Communication error
1	Current	5	Device profile specific error
2	Voltage	6	Reserved
3	Temperature	7	Manufacturer specific error

### 9.1.2.3 0x1003/n Pre-Defined Error Field

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1003	0	Pre-defined error field	Unsigned32	ro	No	0

SubIndex 0 gives the number of stored errors (max 5) and is 8 Bit wide. The other subindexes give the stored errors as 32-bit vars.

„Error Code“ is the DS402 Error number. „Additional Information“ is the Axia Error Number.

### 9.1.2.4 0x1005 COB-ID SYNC Message

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1005	0	COB-ID SYNC message	Unsigned32	r/w	No	0x80

☞ 8.6.

### 9.1.2.5 0x1006 Comm Cycle Period

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1006	0	Comm cycle period	Unsigned32	r/w	No	0

☞ 8.6.

### 9.1.2.6 0x1008 Manufacturer Device Name

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1008	0	Manufacturer Device name	Visible string	ro	No	See Text

The device name is displayed as a sequence of ASCII characters.

**Example: "AXIA Vert Single Axis"**

### 9.1.2.7 0x1009 Manufacturer Hardware Version

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1009	0	Manufacturer Hardware version	Visible string	ro	No	See Text

The device version is displayed as a sequence of ASCII characters.

**Example: "AXV 123 456 789"**

### 9.1.2.8 0x100A Manufacturer Software Version

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x100A	0	Manufacturer Software version	Visible string	ro	No	See Text

The software version is displayed as a sequence of ASCII characters.

**Example: V4.00**

### 9.1.2.9 0x100C Guard Time

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x100C	0	Guard Time	Unsigned16	r/w	No	See Text

☞ 8.8.

### 9.1.2.10 0x100D Lifetime Factor

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x100D	0	Lifetime Factor	Unsigned8	r/w	No	See Text

8.8.

### 9.1.2.11 0x1010 Store Parameters

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1010	255	Store parameters	Unsigned32	ro	No	0

With object **0x1010** object/object settings can be stored to non-volatile memory.

Writing of "save" in **0x1010** saves all application objects (**0x6nnn**) in the non-volatile memory.

#### Specification for writing the "save" instruction

LSB			MSB
"s"	"a"	"v"	"e"
0x73	0x61	0x76	0x65



Writing of values other than "save" will result in cancellation of SDO. The store command is **not** processed.

### 9.1.2.12 0x1011 Restore Default Parameters

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1011	255	Restore Default Parameters	Unsigned32	ro	No	0

With object **0x1011**, you can reset objects/objects to the default values.

Writing of "load" in **0x1011** restores all application objects (**0x6nnn**).

#### Specification for writing the "load" instruction

LSB			MSB
"l"	"o"	"a"	"d"
0x6C	0x6F	0x61	0x64



Writing of values other than "load" will result in cancellation of SDO. The restore defaults command is **not** processed.

### 9.1.2.13 0x1014 COB-ID EMCY

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1014	0	COB-ID EMCY	Unsigned32	r/w	No	0

Possible values:

0x80 + NodeID,

0x80-0x100, 0x200, 0x280, 0x300, 0x380 0x400, 0x480, 0x500, 0x580, 0x600, 0x680-0x6DF



Refer to the DS301 standard for more information.

### 9.1.2.14 0x1016 Consumer heartbeat time

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1016	0	Consumer heartbeat time	Unsigned32	r/w	No	0

8.9.

### 9.1.2.15 0x1017 Producer heartbeat time

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1017	0	Producer heartbeat time	Unsigned16	r/w	No	0

8.9.

### 9.1.2.16 0x1018/n Identity Object

The object *identity* provides information about the device manufacturer and the device.

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1018	0	Highest Sub-index supported	Unsigned8	ro	No	4
	1	Vendor ID	Unsigned32	ro	No	See text
	2	Product code	Unsigned32	ro	No	See text
	3	Revision number	Unsigned32	ro	No	See text
	4	Serial number	Unsigned32	ro	No	See text

"Vendor ID" "0xD5" refers to manufacturer **BONFIGLIOLI GmbH**.

This "Vendor ID" is assigned by the CANopen® user organization "CAN in Automation" (CiA) in Erlangen ([www.can-cia.org](http://www.can-cia.org)).

#### Product code:

shows the type ID of the frequency inverter. 0x0001.0001 for AXIAvert Single Axis

#### Revision number:

shows the revision level of the CANopen® system of the frequency inverter.

#### Serial number:

shows the serial number of the frequency inverter.

### 9.1.2.17 0x1029 Error behavior

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1029	255	Error behavior	Unsigned8	r/w	No	0

Guarding and heartbeat fault behavior:

- 0 enter pre-operational ,
- 1 no change ,
- 2 stop

☞ 8.8, 8.9.

### 9.1.2.18 0x1200 SDO server parameter

Index	Sub-Index	Meaning	Data Type	Access	Map	Def.-Val
0x1200	0	Highest sub-index supported	Unsigned8	ro	No	2
	1	COB-ID client → server (Rx)	Unsigned32	ro	No	See text
	2	COB-ID server → client (Tx)	Unsigned32	ro	No	See text

Object **0x1200** defines the SDO server parameters. The values are read-only and pre-defined according to the device node address.

COB-ID client → server (Rx) = 1536 + Node Address

COB-ID server → client (Tx) = 1408 + Node Address

Object 0x1200/1, 2																																							
Bit 31		Bit 30		Bit 29		Bit 11 ... 28			Bit 0 ... 10																														
valid		0		frame		0			11 Bit CAN-ID																														
Bit 31:		0 = SDO exists / valid				<div>Example:</div> <table><tr><td></td><td>COB ID</td><td>CB</td><td>Index</td><td>SI</td><td>Data</td></tr><tr><td>Bit 29:</td><td>0</td><td colspan="4">= 11 Bit ID</td></tr><tr><td colspan="2"></td><td colspan="4"></td></tr><tr><td colspan="2">Bit 0 ... 10:</td><td colspan="4">11 Bit CAN-ID</td><td colspan="5"></td></tr></table>						COB ID	CB	Index	SI	Data	Bit 29:	0	= 11 Bit ID										Bit 0 ... 10:		11 Bit CAN-ID								
	COB ID	CB	Index	SI	Data																																		
Bit 29:	0	= 11 Bit ID																																					
Bit 0 ... 10:		11 Bit CAN-ID																																					

CB: Control byte SI: Sub-Index All values in hexadecimal without leading "0x"

### 9.1.2.19 0x140n/n, RxPDO Communication Objects

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1400 0x1401 0x1402 0x1403	0	Highest sub-index supported	Unsigned8	ro	No	2
	1	COB ID	Unsigned32	r/w	No	See text
	2	Transmission type	Unsigned8	r/w	No	255
	3	Inhibit time	Unsigned16	r/w	No	See text
	5	Event time	Unsigned16	r/w	No	See text

#### RxPDO Communication objects:

**0x1400/n** RxPDO1 COB-ID Default value: 0x200 (=512) +Node ID

**0x1401/n** RxPDO2 COB-ID Default value: 0x300 (=768) +Node ID

**0x1402/n** RxPDO3 COB-ID Default value: 0x400 (=1024) +Node ID

**0x1403/n** RxPDO3 COB-ID Default value: 0x500 (=1280) +Node ID

These communication objects define the COB-ID and transmission type used by the RxPDOs. Only sub-indexes **1**, **2** and **5** are used for RxPDOs. The default setting for the used COB-ID depends on the Node ID and can be changed. The default value for transmission type is 255 (event driven) and can also be changed (see table).

Object 0x1400/0x1401/0x1402/0x1403 COB-ID				
Bit 31	Bit 30	Bit 29	Bit 11 ... 28	Bit 0 ... 10
valid	<b>0</b>	frame	<b>0</b>	11-bit CAN-ID

Bit 31:0 = PDO existent/valid

1 = PDO non-existent/not valid

Bit 29:0 = 11 Bit ID

1 = 29 Bit ID **NOT ALLOWED**

Bit 0 ... 10: 11-bit CAN-ID

**RxPDO1 factory setting = valid**

**RxPDO2/3 factory setting = not valid**

Object 0x1400/0x1401/0x1402/0x1403 transmission type		
Value	meaning	description
0	synchronous	Update RxPDO data on <b>each</b> SYNC
1 ... 240	synchronous	Update RxPDO data on <b>each</b> SYNC
<del>241 ... 251</del>	reserved	Value not allowed
<del>252</del>	synchronous/RTR	Value not allowed
<del>253</del>	asynchronous/RTR	Value not allowed
254	asynchronous	Event driven (manufacturer specific)
255	asynchronous	Event driven (profile specific) <b>default value</b>

Values 254 + 255 are handled identically. Update RxPDO data on each Rx.

#### Inhibit time:

The inhibit time for RxPDO is without function. Values can be entered, but they are without further function.

#### Event time:

The event time is used as monitoring function for RxPDO's. If during the set time no RxPDO is received, one of the following faults is triggered:

- 202A Fault RxPDO1
- 202B Fault RxPDO2
- 202C Fault RxPDO3

**Example\*:**

	COB ID	CB	Index	SI	Data
Read Request	601	40	00 14	02	00
Reply	581	4F	00 14	02	FF
Read Request	601	40	00 14	01	00
Reply	581	4F	00 14	01	01 02 00 00
Write Access	601	23	00 14	01	01 02 00 80
Reply *	581	60	00 14	01	00 00 00 00
Write Access	601	2F	00 14	02	05
Reply *	581	60	00 14	02	00
Write Access	601	23	00 14	01	01 02 00 00
Reply *	581	60	00 14	01	00 00 00 00

CB: Control byte SI: Subindex All values in hexadecimal without leading 0x

\* Note, that Object **1400/1** Highest has to be deactivated first for the correct Write access for Object **1400/2**.

### 9.1.2.20 0x160n/n, RxPDO Mapping Object

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1600	0	Number of mapped objects	Unsigned8	r/w	No	2
	1	1 <sup>st</sup> mapped obj.	Unsigned32	r/w	No	See text
	2	2 <sup>nd</sup> mapped obj.	Unsigned8	r/w	No	See text
	3	3 <sup>rd</sup> mapped obj.	Unsigned8	r/w	No	See text
	4	4 <sup>th</sup> mapped obj.	Unsigned8	r/w	No	See text
	5	5 <sup>th</sup> mapped obj.	Unsigned8	r/w	No	See text
	6	6 <sup>th</sup> mapped obj.	Unsigned8	r/w	No	See text
	7	7 <sup>th</sup> mapped obj.	Unsigned8	r/w	No	See text
	8	8 <sup>th</sup> mapped obj.	Unsigned8	r/w	No	See text

#### RxPDO Mapping objects:

**0x1600/n** RxPDO1

**0x1601/n** RxPDO2

**0x1602/n** RxPDO3

**0x1603/n** RxPDO4

**0x1600/0** = 0 = no object mapped

**0x1600/0** = 1 ... 8 = 1 ... 8 mapped objects

#### Mapping entry:

MSB			LSB
Object index		Subindex	Length (no. of bits)
High byte	Low byte	si	ll

#### Examples:

Mapping of **0x6040/0** Control word (unsigned16 = 10hex) to 1st mapped object in RxPDO1:

**0x1600/1** = **0x60400010**

Mapping of **0x60C1/1** interpolation data record 1 (integer32 = 20hex) to 2nd mapped object in RxPDO1:

**0x1600/2** = **0x60C10120**

## Default mapping

RxPDO1	0x1600/0	0x1600/1	0x1600/2	0x1600/3...8
	2	0x6040 Control word	0x6042 vl target velocity	0x00000000
RxPDO2	0x1601/0	0x1601/1...8		
	1	0x6040 Control word		
RxPDO3	0x1602/0	0x1602/1...8		
	1	0x6040 Control word		
RxPDO4	0x1603/0	0x1603/1...8		
	1	0x6040 Control word		

### Example\*:

	COB ID	CB	Index	SI	Data
Read Request	601	40	00 16	01	00 00 00 00
Reply	581	43	00 16	01	10 00 40 60
Write Access	601	2F	00 16	00	00
Reply *	581	60	00 16	00	00 00

CB: Control byte SI: Subindex All values in hexadecimal without leading 0x

\* Note, that Object **1400/1** Highest bit has to be deactivated first for the correct Write access for Object **1600/n**. See also the Mapping sequence described in the following.

## Mapping Sequence

The mapping sequence requires five steps:

### Step 1:

Set PDO to "not valid" (**0x1400**, Subindex 1, Bit 31 = 1)

### Step 2:

Set subindex 0 to 0 (deactivate current mapping, **0x1600**, Subindex 0 = 0)

### Step 3:

Set subindex 1 ... n to the new objects (**0x1600**, Subindex 1..n = new object)

### Step 4:

Set subindex 0 to the number of mapped objects (activate new mapping, **0x1600**, Subindex 0 = n)

### Step 5:

Set PDO valid (**0x1400**, Subindex 1, Bit 31 = 0)

TxPDO **0x1600** is used exemplary above. The same procedure applies to **0x1601**, **0x1602** and **0x1603**. In these cases, **0x1400** has to be substituted accordingly with **0x1401**, **0x1402** or **0x1403**.

### Example (Node ID = 1):

	COB ID	Control byte	Index LSB MSB	Subindex Subindex	Data LSB ...	Data ... MSB
Step 1:	601	23	00 14	01	01 02	00 80
Response	581	60	00 14	01	00 00	00 00
Step 2:	601	2F	00 16	00	00	
Response	581	60	00 16	00	00	
Step 3.1:	601	23	00 16	01	10 00	42 60
Response	581	60	00 16	01	00 00	00 00
Step 3.2:	601	23	00 16	02	10 00	40 60
Response	581	60	00 16	02	00 00	00 00
Step 3.3:	601	23	00 16	03	08 00	60 60
Response	581	60	00 16	03	00 00	00 00
Step 4:	601	2F	00 16	00	03	
Response	581	60	00 16	00	00	
Step 5:	601	23	00 14	01	01 02	00 00
Response	581	60	00 14	01	00 00	00 00

### Resulting mapping

Target velocity (0x6042)	Control word (0x6040)	Modes of operation (0x6060)
00 00	00 00	00

This example shows the necessary telegrams with the according responses of the device.

#### 9.1.2.21 0x180n/n, TxPDO Communication Objects

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1800 0x1801 0x1802 0x1803	0	Highest sub-index supported	Unsigned8	ro	No	5
	1	COB ID	Unsigned32	r/w	No	See text
	2	Transmission type	Unsigned8	r/w	No	255
	3	Inhibit time	Unsigned16	r/w	No	See text
	4	-	-	-	-	-
	5	Event time	Unsigned16	r/w	No	See text

### TxPDO Communication objects:

**0x1800/n** TxPDO1 COB-ID Default value: 0x180 (=384) +Node ID

**0x1801/n** TxPDO2 COB-ID Default value: 0x280 (=640) +Node ID

**0x1802/n** TxPDO3 COB-ID Default value: 0x380 (=896) +Node ID

**0x1803/n** TxPDO3 COB-ID Default value: 0x480 (=1152) +Node ID

These communication objects define the COB-ID and transmission type used by the TxPDOs. The default setting for the COB-ID depends on the Node ID and can be changed. The default value for the transmission type is 255 (event driven) and can also be changed (see table).

Object 0x1800/0x1801//1802 COB-ID				
Bit 31	Bit 30	Bit 29	Bit 11 ... 28	Bit 0 ... 10
valid	0	frame	0	11-bit CAN-ID

Bit 31:0 = PDO existent / valid

1 = PDO non-existent / not valid

Bit 29:0 = 11 Bit ID

1 = 29 Bit ID **NOT ALLOWED**

Bit 0 ... 10:

11-bit CAN-ID



**TxPDO1 factory setting = valid**

**TxPDO2/3 factory setting = not valid**

Object 0x1800/0x1801/0x1802/0x1803 transmission type		
value	meaning	description
0	Synchronous	Update TxPDO data and send on SYNC <b>only</b> when data has changed
1 ... 240	Synchronous	Update TxPDO data and send on <b>each</b> "n" SYNC
<del>241 ... 251</del>	Reserved	Value not allowed
252	synchronous/RTR	Update TxPDO data on SYNC and send <b>on following</b> RTR
253	asynchronous/RTR	Update TxPDO data and send on RTR
254	asynchronous	Event driven (manufacturer specific)
255	asynchronous	Event driven (profile specific) <b>default value</b>

Values 254 + 255 are handled identically. Send TxPDO on data change or event time.

### Inhibit time:

The inhibit time is the minimum time distance between two consecutive TxPDOs for asynchronous TxPDOs. During the inhibit time, the TxPDO is not sent again. Therefore, a value change occurring in this time is sent after the inhibit time has elapsed at the earliest. The value range is 0...65535.

The inhibit time is set in hundreds of microseconds, e.g. a value of 300 is  $300 * 100 \mu s = 30 \text{ ms}$ .



The device internal time resolution for the inhibit time is in milliseconds, the last digit is always converted to "0". An inhibit time value = 37 is truncated to 30 [3.7 ms → 3 ms].

Values less than 10 are interpreted as 0.

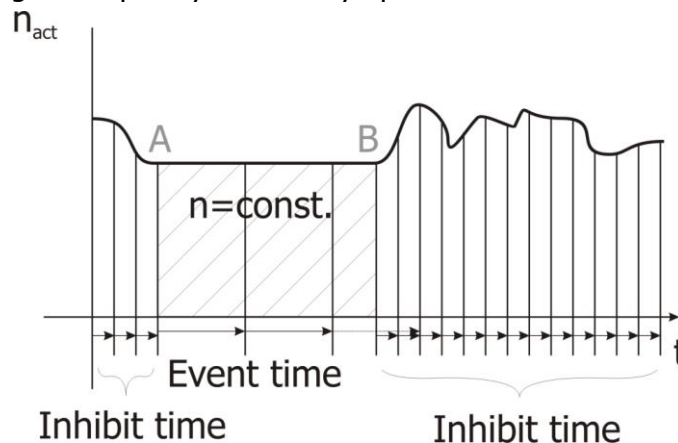
### Event time:

The event time is the time distance between two consecutive TxPDOs whenever the TxPDO data has not changed (cycle time). If the inhibit time is set to zero the TxPDO is only sent on a change of the TxPDO's data. The value range is 0...65535.

The event time is set in milliseconds, e.g. a value of 2000 = 2000 ms.

### Example Event time & Inhibit time:

The actual speed value is transferred via TxPDO. The value is updated after the inhibit time has elapsed. At time A, the value remains constant. During this time, the value is updated after the Event time has elapsed. At time B, the value changes and is transmitted via TxPDO. The value changes again frequently and is only updated after the inhibit time has elapsed



### Sub-index 4:

Sub-index 4 is included for compatibility reasons. An SDO read/write access to subindex 4 results in an SDO abort.

Example*:					
	COB ID	CB	Index	SI	Data
Read Request	601	40	00 18	02	00
Reply	581	4F	00 18	02	FF
Read Request	601	40	00 18	01	00
Reply	581	4F	00 18	01	81 01 00 00
Write Access	601	23	00 18	01	81 01 00 80
Reply *	581	60	00 18	01	00 00 00 00
Write Access	601	2F	00 18	02	05
Reply *	581	60	00 18	02	00
Write Access	601	23	00 18	01	81 01 00 00
Reply *	581	60	00 18	01	00 00 00 00

CB: Control byte SI: Sub-index All values in hexadecimal without leading 0x

\* Note, that Object **1800/1** highest bit has to be deactivated first for the correct Write access for Object **1800/2**.

### 9.1.2.22 0x1A0n/n, TxPDO Mapping Object

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1A00 0x1A01 0x1A02 0x1A03	0	Number of mapped objects	Unsigned8	r/w	No	2
	1	1 <sup>st</sup> mapped obj.	Unsigned32	r/w	No	See text
	2	2 <sup>nd</sup> mapped obj.	Unsigned32	r/w	No	See text
	3	3 <sup>rd</sup> mapped obj.	Unsigned32	r/w	No	See text
	4	4 <sup>th</sup> mapped obj.	Unsigned32	r/w	No	See text
	5	5 <sup>th</sup> mapped obj.	Unsigned32	r/w	No	See text
	6	6 <sup>th</sup> mapped obj.	Unsigned32	r/w	No	See text
	7	7 <sup>th</sup> mapped obj.	Unsigned32	r/w	No	See text
	8	8 <sup>th</sup> mapped obj.	Unsigned32	r/w	No	See text

### TxPDO Mapping objects:

**0x1A00/n** TxPDO1

**0x1A01/n**, TxPDO2

**0x1A02/n**, TxPDO3

**0x1A03/n** TxPDO4

**0x1A00/0** = 0 = no object mapped

**0x1A00/0** = 1 ... 8 = 1 ... 8 mapped objects

### Mapping entry:

MSB		LSB	
Object index		Subindex	Length (no. of bits)
High byte	Low byte	si	ll

### Examples:

Mapping of **0x6041/0** Statusword (unsigned16) to "1<sup>st</sup> mapped obj." in TxPDO1:

**0x1A00/1** = 0x60410010

Mapping of **0x6064/0** Position actual value (integer32) to "2<sup>nd</sup> mapped obj." in TxPDO1:

**0x1A00/2** = 0x60640020

## Default mapping

TxPDO1	0x1A00/0	0x1A00/1	0x1A00/2	0x1A00/3...8
	2	0x6041 Status word	0x6044 vl velocity actual value	0x00000000
TxPDO2	0x1A01/0	0x1A01/1		
	0	0x6041 Status word		
TxPDO3	0x1A02/0	0x1A02/1		
	0	0x6041 Status word		
TxPDO4	0x1A03/0	0x1A03/1		
	0	0x6041 Status word		

### 9.1.2.23 0x1F51, Program control Object

Index	Sub-index	Meaning	Data type	Access	Map	Def.-Val
0x1F51	255	Program control	Unsigned8	r/w	No	1

This object allows changing and querying the state of a program.

The `clear` command is only allowed for the state `Stopped/StoppedReset/NoProg` (Flash must be present and no write or delete process is active). If `clear` is transmitted via CANopen, the file addressed in the subindex shall be deleted. The object is then prepared for the block programming. If transmitted via protocols other than CANopen, the `clear` command shall be ignored.

```

CANopen_EProgramControl_Stop    = 0,
CANopen_EProgramControl_Start  = 1,
CANopen_EProgramControl_Reset  = 2,
CANopen_EProgramControl_Clear  = 3,
CANopen_EProgramState_Stopped   = 0,
CANopen_EProgramState_Started   = 1,
CANopen_EProgramState_StoppedReset = 2,
CANopen_EProgramState_NoProg    = 3,

```

`Stop`, `Start` and `Reset` may always be written. They do not have consequences for the inverter functionality.

The write process is started with the command `CANopen_EProgramControl_Clear`.

Depending on the SubIndex of **0x1F51** the corresponding program is opened. This deletes the memory array. The process takes 30 s to complete.

### 9.1.2.24 0x1F56 Program software identification

This object gives back either the version of the file addressed via the SubIndex, or 0, if there is no valid file.

### 9.1.2.25 0x1F57 Flash status register

The object displays by the value 0 that no error is present. During data transmission the value is 1. In the case of transmission abort the value is a combination of the inverter error code and the CANopen error code.

The following error messages are defined in CANopen for the file download. The error code is transmitted in 7 Bits of the object.

```

CANopen_EErr1F57_NoErr          = 0,
CANopen_EErr1F57_NoValidProgramAvailable = 1,
CANopen_EErr1F57_DataFormatUnknown = 2,
CANopen_EErr1F57_DataFormatOrCrcErr = 3,
CANopen_EErr1F57_FlashNotCleared = 4,
CANopen_EErr1F57_FlashWriteErr  = 5,

```

```
CANopen_EErr1F57_GeneralAddressErr    = 6,  
CANopen_EErr1F57_FlashSecured          = 7,  
CANopen_EErr1F57_UnspecifiedErr        = 63,  
CANopen_EErr1F57_ManufErr0Timeout      = 64,  
CANopen_EErr1F57_ManufErr1ClientAbort  = 65,
```

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## AUSTRALIA

### Bonfiglioli Transmission (Aust.) Pty Ltd

2, Cox Place Glendenning NSW 2761  
Locked Bag 1000 Plumpton NSW 2761  
Tel. +61 2 8811 8000



## BRAZIL

### Bonfiglioli Redutores do Brasil Ltda

Travessa Cláudio Armando 171 -  
Bloco 3 CEP 09861-730 - Bairro  
Assunção  
SãoBernardodoCampo-SãoPaulo  
Tel. +55 11 4344 2322



## CHINA

### Bonfiglioli Drives (Shanghai) Co. Ltd.

#68, Hui-Lian Road, QingPu  
District, 201707 Shanghai  
Tel. +86 21 6700 2000



#568, Longpan Road, Jiading District,  
201707 Shanghai



### Bonfiglioli Trading (Shanghai) Co. Ltd.

Room 423, 4<sup>th</sup> Floor, #38, Yinglun  
Road, China (Shanghai) Pilot Free  
Trade Zone, Shanghai



## FRANCE

### Bonfiglioli Transmission s.a.

14 Rue Eugène Pottier  
Zone Industrielle de Moimont II  
95670 Marly la Ville  
Tel. +33 1 34474510



## GERMANY

### Bonfiglioli Deutschland GmbH

Sperberweg 12 - 41468 Neuss  
Tel. +49 0 2131 2988 0



### Bonfiglioli Deutschland GmbH Krefeld

Europark Fichtenhain B6 - 47807 Krefeld  
Tel. +49 0 2151 8396 0



### O&K Antriebstechnik GmbH

Ruhrallee 8-12 - 45525 Hattingen  
Tel. +49 0 2324 2050 1



## INDIA

### Bonfiglioli Transmission Pvt. Ltd.

#### Mobility & Wind Industries

AC 7 - AC 11 Sidco Industrial Estate  
Thirumudivakkam Chennai - 600 044  
Tel. +91 844 844 8649



#### Discrete Manufacturing & Process Industries - Motion & Robotics

Survey No. 528/1,  
Perambakkam High Road Mannur  
Village,  
Sriperumbudur Taluk Chennai - 602105  
Tel. +91 844 844 8649



#### Discrete Manufacturing & Process Industries

Plot No.A-9/5, Phase IV MIDC Chakan,  
Village Nighoje Pune - 410 501  
Tel. +91 844 844 8649



## ITALY

### Bonfiglioli S.p.A. Riduttori Discrete Manufacturing &

#### Process Industries

Via Cav. Clementino Bonfiglioli, 1  
40012 Calderara di Reno  
Tel. +39 051 6473111



#### Discrete Manufacturing & Process Industries

Via Sandro Pertini, lotto 7b  
20080 Carpiano  
Tel. +39 02985081



#### Discrete Manufacturing & Process Industries

Via Saliceto, 15 - 40010 Bentivoglio



#### Mobility & Wind Industries

Via Enrico Mattei, 12 Z.I. Villa Selva  
47122 Forlì  
Tel. +39 0543 789111



#### Motion & Robotics

Via Unione, 49 - 38068 Rovereto  
Tel. +39 0464 443435/36



## NEW ZEALAND

### Bonfiglioli Transmission (Aust.) Pty Ltd

88 Hastie Avenue, Mangere Bridge,  
2022 Auckland  
PO Box 11795, Ellerslie  
Tel. +64 09 634 6441



## SINGAPORE

### Bonfiglioli South East Asia Pte Ltd

8 Boon Lay Way, #04-09,  
8@ Tadehub 21, Singapore 609964  
Tel. +65 6268 9869



## SLOVAKIA

### Bonfiglioli Slovakia s.r.o.

Robotnícka 2129  
Považská Bystrica, 01701 Slovakia  
Tel. +421 42 430 75 64



## SOUTH AFRICA

### Bonfiglioli South Africa Pty Ltd.

55 Galaxy Avenue, Linbro Business Park,  
Sandton, Johannesburg  
2090 South Africa  
Tel. +27 11 608 2030



## SPAIN

### Tecnotrans Bonfiglioli S.A

Pol. Ind. Zona Franca, Sector C,  
Calle F, nº 6 - 08040 Barcelona  
Tel. +34 93 447 84 00



## TURKEY

### Bonfiglioli Turkey Jsc

Atatürk Organize Sanayi Bölgesi,  
10007 Sk. No. 30  
Atatürk Organize Sanayi Bölgesi,  
35620 Çiğli - İzmir  
Tel. +90 0 232 328 22 77



## UNITED KINGDOM

### Bonfiglioli UK Ltd.

Unit 1 Calver Quay, Calver Road, Winwick  
Warrington, Cheshire - WA2 8UD  
Tel. +44 1925 852667



## USA

### Bonfiglioli USA Inc.

3541 Hargrave Drive  
Hebron, Kentucky 41048  
Tel. +1 859 334 3333



## VIETNAM

### Bonfiglioli Vietnam Ltd.

Lot C-9D-CN My Phuoc Industrial Park 3  
Ben Cat - Binh Duong Province  
Tel. +84 650 3577411



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