Bonfiglioli Vectron

AXIA VERT

Communication Module Manual

CMA-IE-01 for PROFINET®

Frequency inverter 230 V / 400 V

0,25 kW ... 15 kW

Bonfiglioli

CONTENTS

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 parameters and the configuration of the software of the frequency inverter.

User manual
The user manual documents the complete functionality of the frequency inverter. The parameters 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 of the CMA-IE-01-PN 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 PROFINET® communication module CMA-IE-01-PN in its specified application range. Compliance with user documentation contributes to avoiding risks, minimizing repair cost and downtimes, and increasing the reliability and service live of the frequency inverter.

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

PROFINET is a registered trademark of PROFIBUS and PROFINET International (PI).

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.

1.3 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.

1.4 Copyright

In accordance with applicable law any copyrights relating to this document shall remain with

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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.

1.5 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.

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 protection class 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 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 inside of the frequency inverter if no external disconnection device was installed by the operator.

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.

2.6.9 Font style in documentation

Example	Font style	Use
0x1234	bold	Representation of object numbers
/01	bold, underlined	Representation of sub-index numbers
/d01	bold, underlined	Representation of data set numbers
Object	Italic, Font Times New Roman	Representation of object names
P.1234	bold	Representation of object numbers without name, e.g. in formulas
Q.1234	bold	Representation of source numbers

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 offers 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 present document describes the possibilities and properties of the PROFINET® communication module CMA-IE-01-PN for the frequency inverters of the *AXIA* series of devices.

Specification:

PROFINET® IO device

Conformance class: C

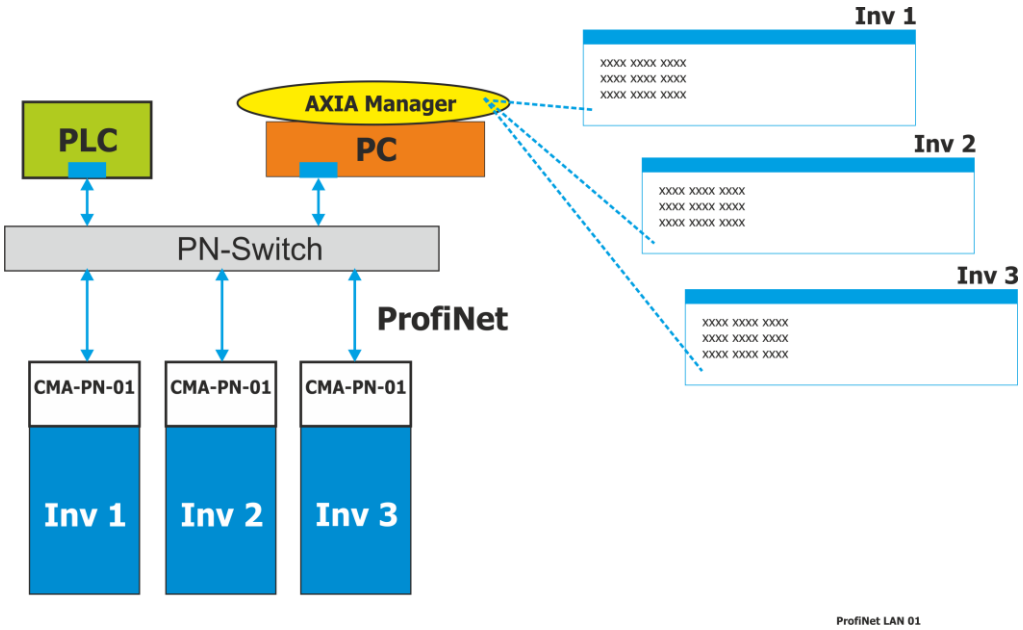
Application class: Isochronous

Netload class: III

Realtime classes: 1 and 3

For a PROFINET® connection, the frequency inverter must be equipped with the CMA-IE-01-PN communication module. The CMA-IE-01-PN component is supplied separately and must be installed by the operator. The installation procedure is described in chapter 4.1 "Installation".

This manual is not to be understood as providing general/basic information on PROFINET® bus architecture or protocol. This document presupposes basic knowledge of the methods and effects of PROFINET® on the user's side.



The PROFINET® component CMA-IE-01-PN has vendor ID **0x020B** (hexadecimal). The latest device description can be downloaded from the Bonfiglioli.com website. The file bears a name similar to **GSDML-V2.35-Bonfiglioli-020B-Axia-20220419.xml**, where the version number and the date might be updated.

The vendor ID is assigned by PROFIBUS Nutzerorganisation e. V. in Karlsruhe.

WARNING

Physical injuries or major material damage

With the communication module CMA-IE-01-PN, it is possible to access **ALL** frequency inverter objects from a controller.

Changing objects, 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.

- Only qualified persons are allowed to work at the device.

3.1 Initialization time

When the frequency inverter is turned on, the communication module must be initialized in addition to the frequency inverter. The initialization can take up to 2 seconds.

Wait until the initialization phase is complete before starting the communication (RUN LED).

4 Installation/Disassembly of the communication module

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

4.1 Installation

CAUTION

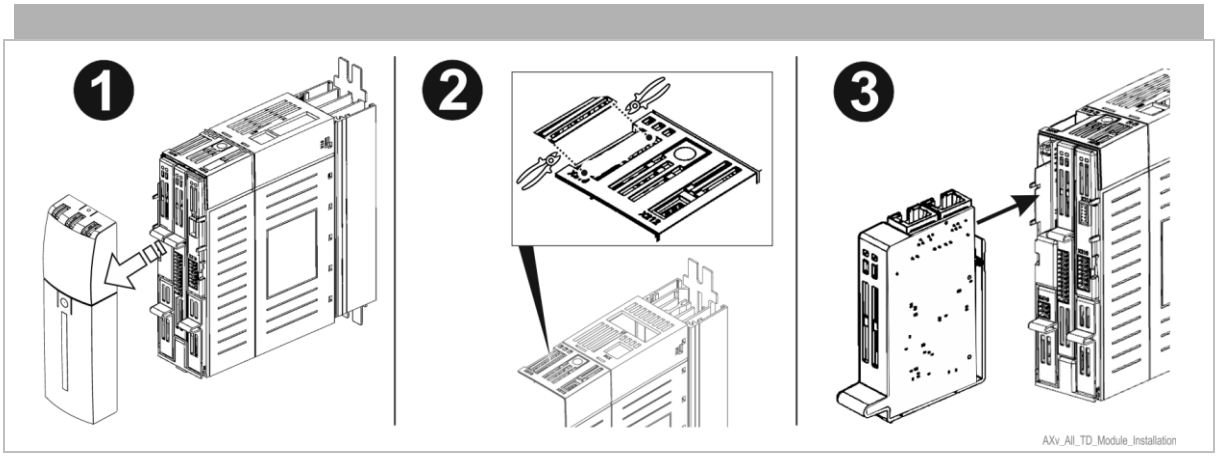
Destroying inverter and/or communication module

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:

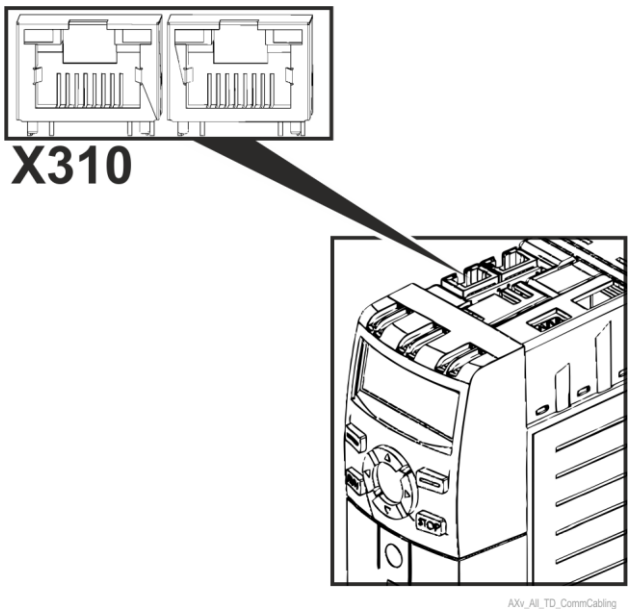
- Disconnect the frequency inverter from the mains voltage and protect it against being energized unintentionally.
- Disconnect the frequency inverter from the external 24 V if used and protect it against being energized unintentionally.



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-IE-01-PN module is connected to the PLC or switch using RJ45 connectors (LAN).



X310	PROFINET®, RJ45

Technical characteristics: PROFINET® interface X310

- 2 RJ45 connectors
- Cable type: S/FTP
  - cable with braided shield
  - ISO/IEC 11801 or EN 50173, Straight Through or Cross Over)
- The cable length is restricted by the PROFINET® specifications, cables must not exceed a length of 100 m.

4.1.2 Status LEDs

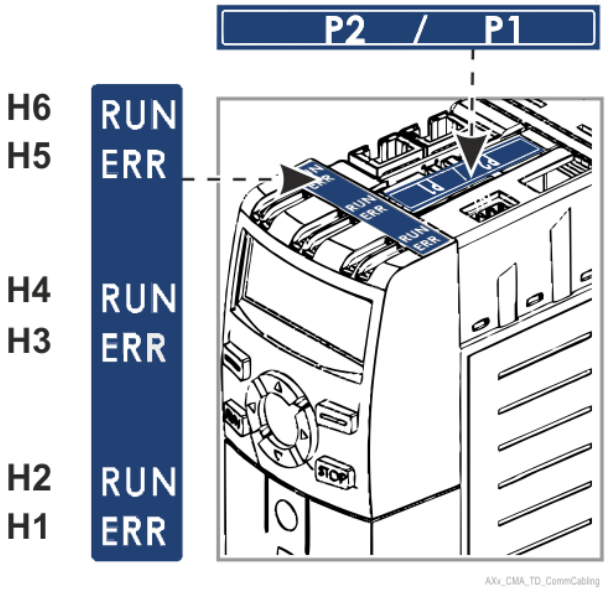
NOTICE

Residual risk

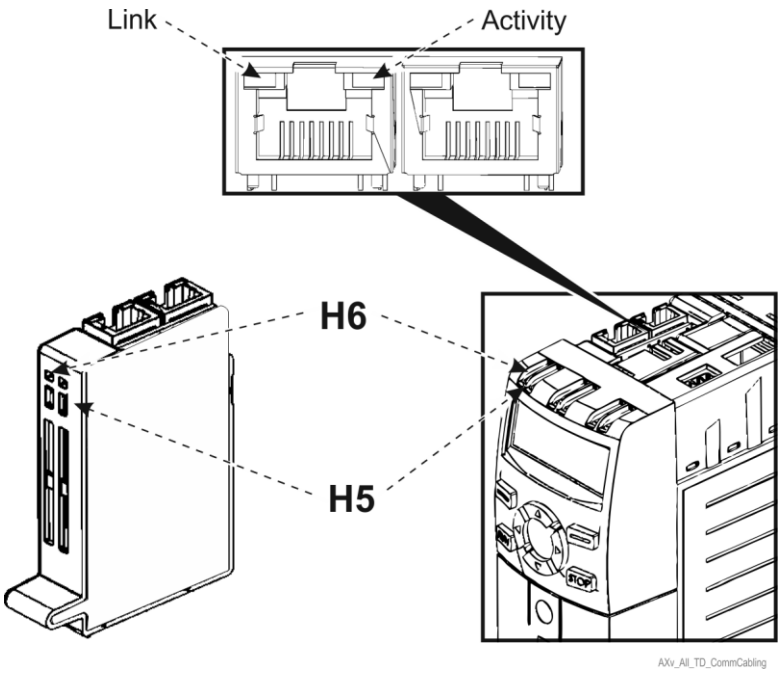
When LEDs and/or other indicating elements on the frequency inverter are not active, the inverter still may be energized.

- 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.



Link/Activity	RJ45 connector LED indicators
H5	Network status LED
H6	Module LED

Link/Activity: RJ45 connector LED indicators
The LEDs in the RJ45 connector indicate data activity (green) and the link (yellow) status of the port or module.

H5: Network status LED

This LED indicates the current status of the network connection.

Network Status LED		
LED State	**Description**	**Comments**
Off	Offline	No power No connection with IO controller
Green	Online (Run)	Connection with IO controller established. IO Controller in RUN state
Green, 1 flash	Online (Stop)	Connection with IO controller established. IO controller in STOP state or IO data bad. IRT synchronization not finished.
Green, blinking	Blink	Used by engineering tools to identify the node on the network.
Red	Fatal event	Major internal error (this indication is combined with a red module status LED).
Red flash	Testing	No connection with IO controller (e.g. cable not connected) The device is performing its power-up testing (Setup and Network initializing).

H6: Module LED

The module LED indicates the current status of the module.

Module Status LED		
LED State	**Description**	**Comments**
Off	Not initialized	No power OR module in SETUP
Green	Normal operation	Normal operation
Green, 1 flash	Diagnostic event(s)	Frequency inverter error
Red	Fatal event	Major internal error (this indication is combined with a red network status LED)
Alternating Red/green	Firmware update	Do NOT power off the module. Turning the module off during this phase could cause permanent damage.

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 Initial Settings

5.1 Setting the Fieldbus System to PROFINET®

The communication module CMA-IE-01-PN can be used for various fieldbus systems with RJ45 connectors. The fieldbus system must be selected at the first start. Use the following object for this purpose:

Index	Sub index	Description	Object code	Data type
0x3904	17	Change Fieldbus	Record	UInt32

- Set the fieldbus system to **0x0000002** `PROFINET I/O`.

5.2 Setting the Station Address

A PROFINET® IO controller accesses IO devices based on unique station names. The station name is assigned during system configuration. The PROFINET® IO controller can also assign the IP settings. During the hardware configuration, it is set for each IO device if the local IP settings are used or the IP settings of the PROFINET® IO controller are applied.

The station name can be changed either via object **0x3916/05** *PROFINET Station name* or TCP/IP Config. function. In both cases, the device must be reset after changing the station name. When using TCP/IP Config. function, the Host name and the station name are changed in one string at the same time.

The station name can also be changed in the PLC. In this case, a reset is not necessary.

In the case of replacement of a module, a special function of the CMA-IE-01-PN module enables assignment of a station name without the PROFINET® configurator.

The TCP/IP configuration shows the IP settings and, as the "Host/station name", the station name is saved in the module.

If a CMA-IE-01-PN module must be replaced, the station name assigned before without PROFINET® configurator can be assigned again.

When the IP settings of the PROFINET® IO controller are applied, the local IP settings on the frequency inverter are blocked. In this case, the Bonfiglioli configuration software AXIA Manager shows "Zero" for IP address, Subnetmask and Gateway. The IP settings cannot be edited via AXIA Manager. If you enter the "Apply" command, the settings entered before are reset to "Zero".

5.3 Configuration via TCP/IP

In order to establish connection with a frequency inverter via TCP/IP configuration use the object **0x3903** *Ethernet Settings*.

Index	Sub index	Description	Object code	Data type
0x3903	1	IP Address (Ref)	Read/write	UInt 32
0x3903	2	Subnetmask (Ref)	Read/write	UInt 32
0x3903	3	Gateway (Ref)	Read/write	UInt 32
0x3903	6	SNTP Server (Ref)	Read/write	UInt 32
0x3903	7	DHCP Option (Ref)	Read/write	Boolean
0x3903	9	Hostname	Read/write	String (max. 20)
0x3903	10	Activate IP Settings	Read/write	UInt8
0x3903	18	TCP Config activated	Read/write	Boolean

The object settings must be adapted to the actual application.

5.3.1 Setting the TCP/IP Address, Subnetmask and Gateway

For proper identification, each frequency inverter is assigned an IP address which must be unique in the system.

5.3.1.1 Network without DHCP server

(DHCP: Dynamic Host Configuration Protocol.) The address is set via object *IP-Address* **0x3903/1**. In addition, the object *Subnetmask* **0x3903/2** and the number of the *Gateway* **0x3903/3** must be entered properly for the local network.

Object		Settings		
No.	Description	Min.	Max.	Default setting
0x3903/1	IP Address (Ref)	0	0xFFFFFFFF	0
0x3903/2	Subnetmask (Ref)	0	0xFFFFFFFF	0
0x3903/3	Gateway	0	0xFFFFFFFF	0
0x3903/10	Activate IP Settings	0	1	0

The settings made with these objects will only become active when setting the object *Activate IP Settings* (**0x3903/10**) to `1`.

5.3.1.2 Network with DHCP server

When a DHCP server is used, manual network configuration is not required. Set *DHCP Option* **0x3903/7** to `1 - Enabled` if you wish to use the DHCP function.

Object		Settings		
No.	Description	Min.	Max.	Default setting
0x3903/7	DHCP Option (Ref)	0	1	0

DHCP (Ref) 0x3903/7	Function
0 - Disabled	Module must be configured manually, no DHCP server is used (**factory setting**).
1 - Enabled	The settings are made by a DHCP server.

When *Activate IP Settings* (**0x3903/10**) is enabled, the IP settings in the RAM are set to 0.

5.3.2 Setting the SNTP Server

The SNTP server is set via subindex 6.

Object		Settings		
No.	Description	Min.	Max.	Default setting
0x3903/6	SNTP Server (Ref)	0	0xFFFFFFFF	0

The SNTP server only becomes active when setting the object *Activate IP Settings* (**0x3903/10**) to `1`.

5.3.3 Setting the Hostname

The hostname is written via subindex 9. Changes become active after a restart.

Object		Settings		
No.	Description	Min.	Max.	Default setting
0x3903/9	Hostname	1	23	Axia-device

5.3.4 Activate TCP Configuration

(UDP: User Datagram Protocol) The object **0x3903/18** can be used to activate the TCP configuration.

Object		Settings		
No.	Description	Min.	Max.	Default setting
0x3903/18	TCP Config activated	0	1	0

6 Setting the process data

Depending on the application used, different process data objects with various lengths and contents are required for data exchange. The CMA-IE-01-PN module enables a wide range of settings. Using a hardware configurator, the user can design the process data objects required for the relevant application.

The required objects must be created in the hardware configuration of the PROFINET® IO controller by configuring the submodules telegrams. On the frequency inverter side it is not possible to set up the required objects. The frequency inverter adjusts itself to the created objects automatically.

For more information on the contents of the telegrams, refer to chapter 7 "Process data exchange".

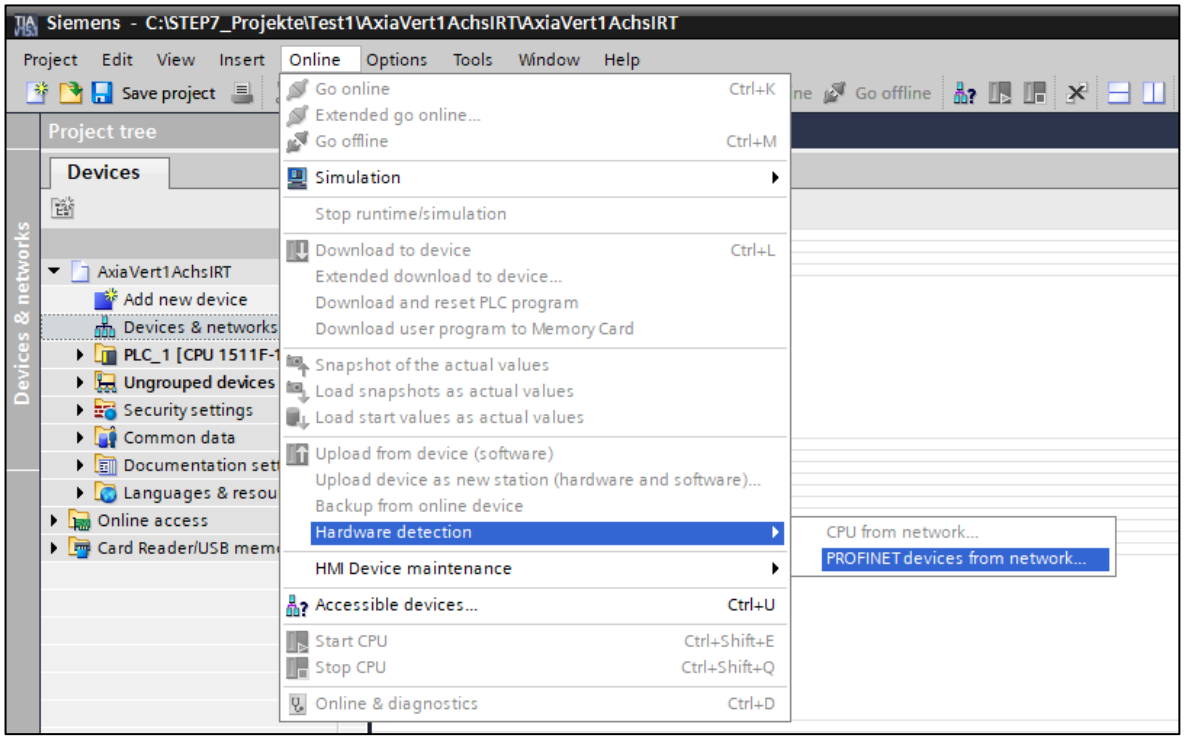
6.1 Configuration process on PROFINET® IO controller

The following chapter describes the configuration procedure of a frequency inverter with the PROFINET® communication module CMA-IE-01-PN using the example of the Siemens TIA Portal automation software. Generally, the procedure is the same for other configurations.

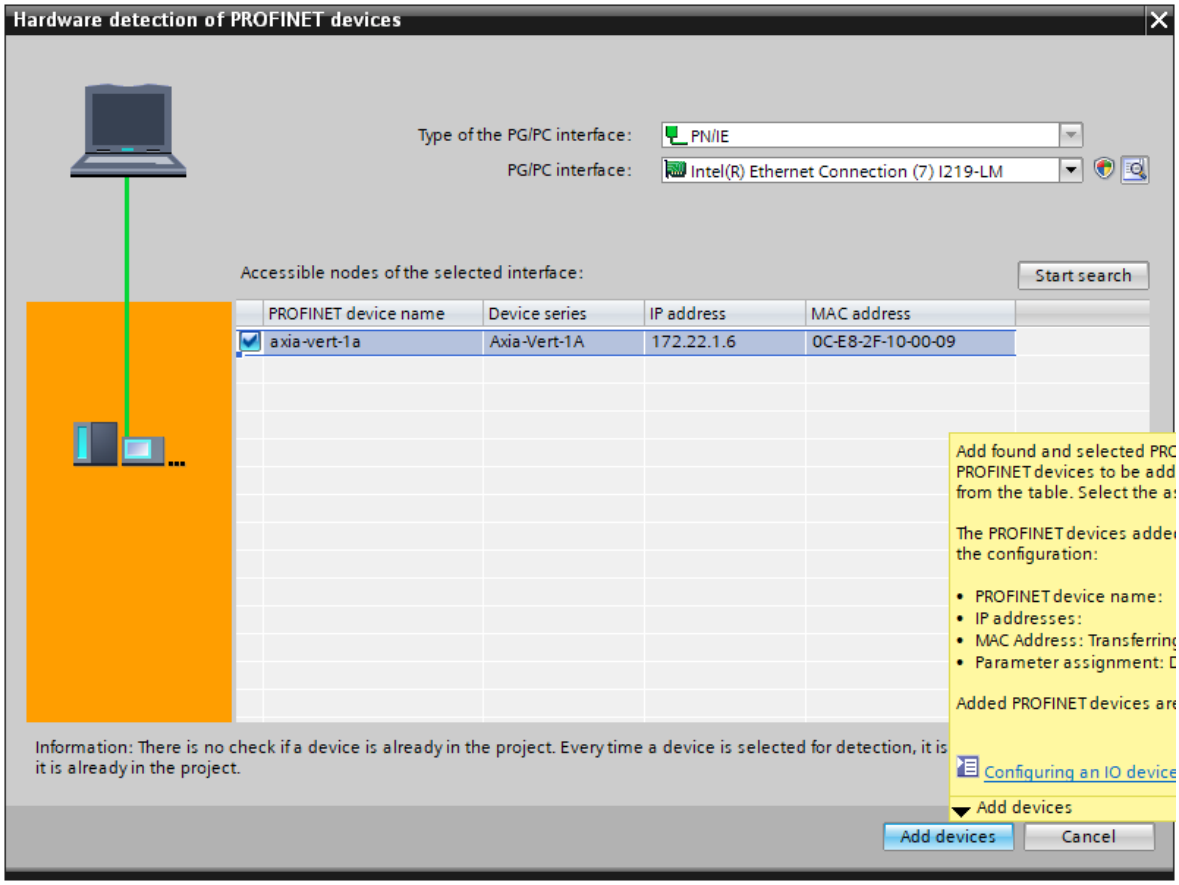
First, the device description file is installed in the hardware configurator (if not done already). This is done in the menu **Options\Install GSD file**. Here, enter the path and name of the GSD file (see chapter 3 "Introduction").

- Open a project in TIA Portal.

Once the GSD file is installed, the frequency inverter can be identified:



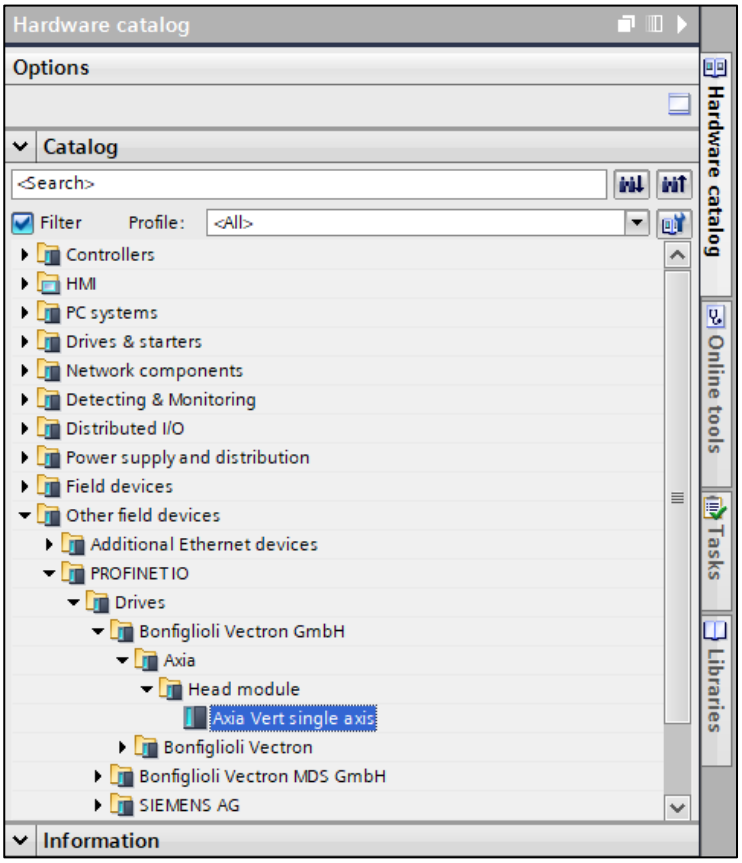
- Select Online > Hardware detection > PROFINET devices from network…



The possible devices will be listed.

Check the desired device and click on the button “Add devices”.

As an alternative, the frequency inverter can also be selected directly from the hardware catalog:



You will find the Axia device in the folder: Field devices \ Other field devices \ PROFINET IO \ Drives \ Bonfiglioli Vectron GmbH \ Axia /Head module

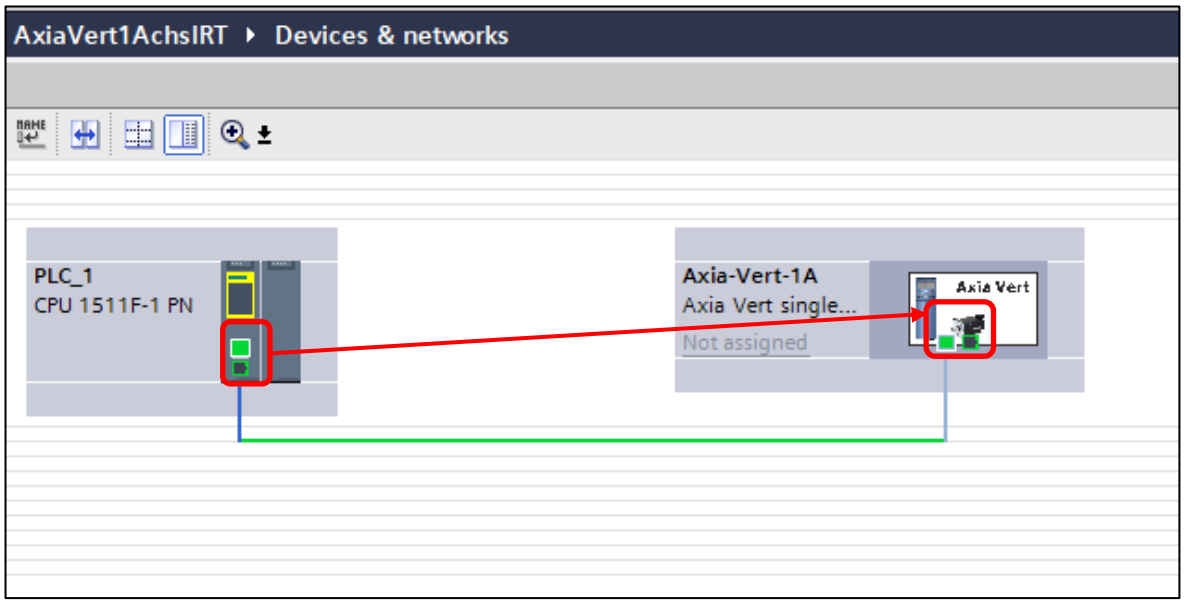
(For better clarity, you can type "Axia Vert" into the search field.)

If you have selected the desired device already and you just want to add a component activate the "Filter" check box for better clarity.)

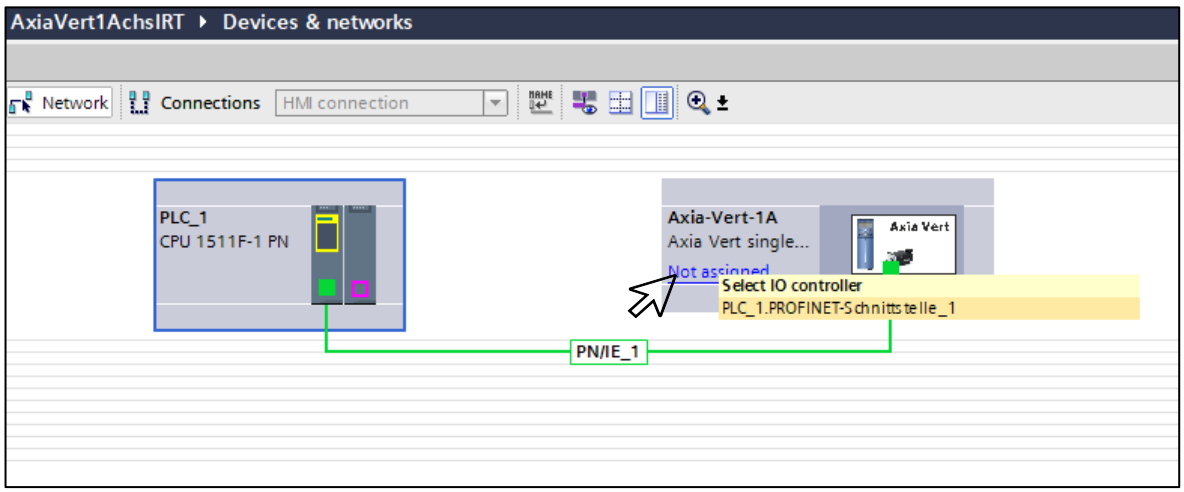
From this position, the frequency inverter can be added to the PROFINET® system:

- Double click on " AXIA Vert single axis". The device will appear in the Devices & networks window of your project. In this window the physical connection between the PLC and the frequency inverter is made.

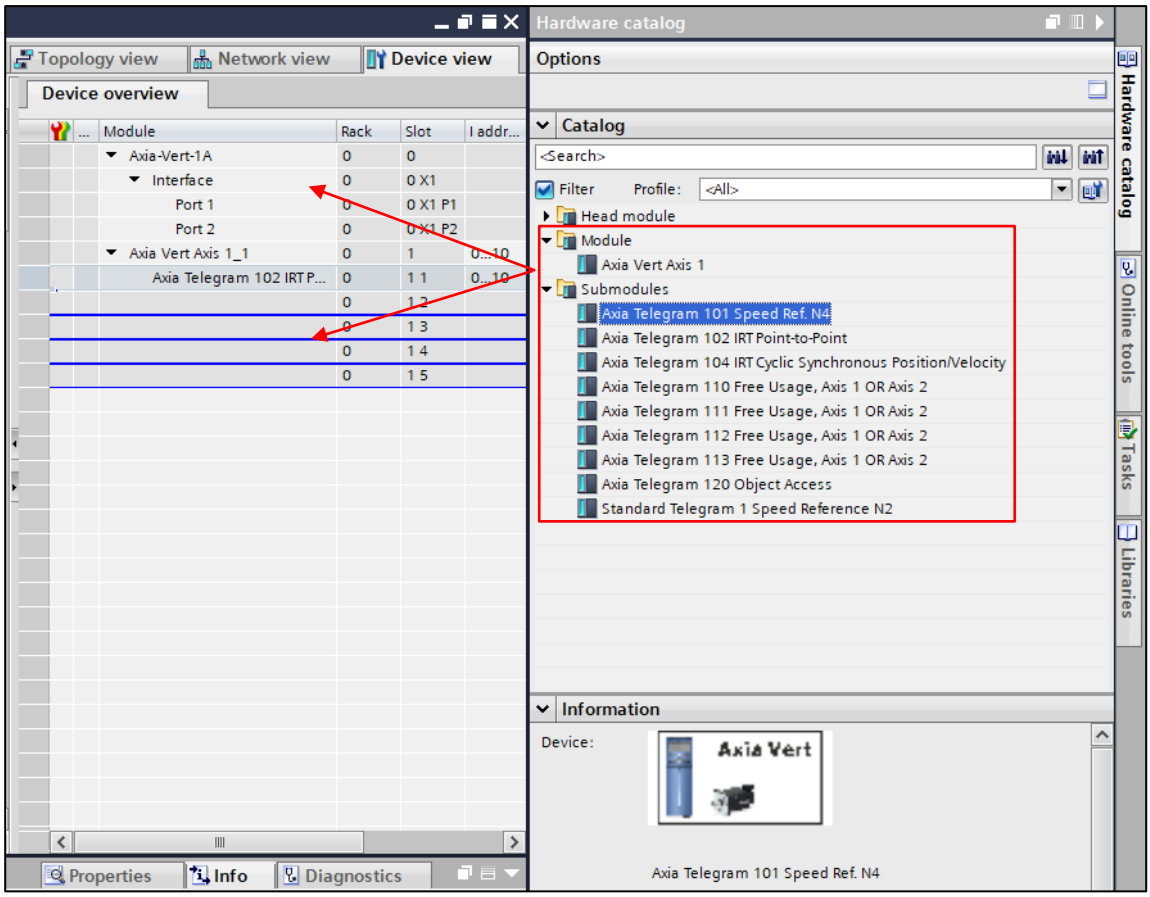
- Select the Topology view in the Devices & networks window.



- Click on the desired port in the PLC. The beginning of the connection line will appear.
- Select the desired port in the frequency inverter (port 1 or port 2). The green line connects between both selected ports.
- Open the network view in the devices & networks window.



- Select the IO controller "PLC_1.PROFINET®-Schnittstelle_1".
- Double click on the Axia device or open the devices overview in the project window.



The available modules and submodules are listed in the Hardware catalog. The required module(s) and submodules can be assigned to the frequency inverter:

- Drag and drop the required modules and submodules from the Catalog window into a free slot in the Device overview window.

After the configuration is complete, this setup must be compiled and downloaded, see chapter 6.3 "Compiling and downloading the configuration".

Restrictions for user-defined configuration settings:

- The total number of selected submodules is 5.
- The total number of bytes must be less than or equal to 24 bytes (12 words).
- The submodule telegrams 001, 101, 102 and 104 can be selected once per axis.
- The submodule telegrams 110–113 and 120 can be selected only once per device for axis 1 or axis 2 (where applicable).
- The submodule telegram 120 access is allowed only in slot 1.

If the restrictions are not followed,

- the controller (PLC) signals a configuration error upon PROFINET® startup;
- the inverter signals an error with the fault code "F275A PROFINET Configuration"

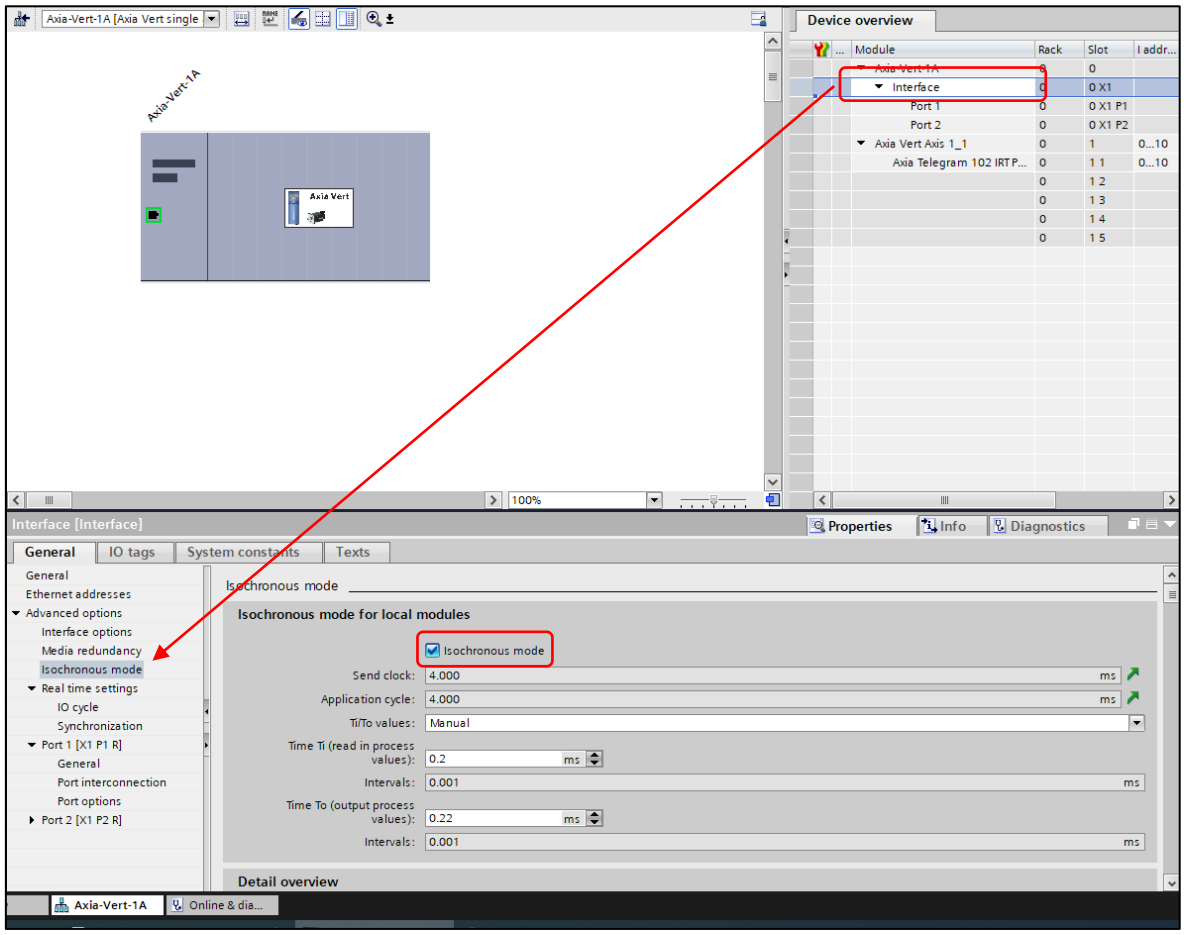
6.1.1 Configuration process for IRT submodules

For the system configuration in cyclic synchronous mode or profile position mode the frequency inverter must be operated in IRT (Isochronous Real Time) mode. Use the telegrams 102 or 104 for this operation.

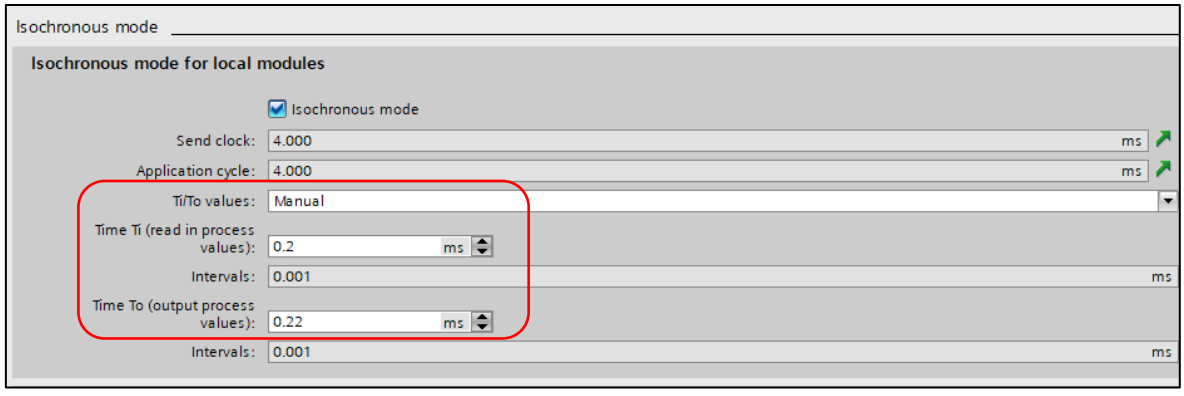
For the configuration in IRT mode, the hardware configurator needs further adjustment.

- Follow the configuration steps in chapter 6.1 "Configuration process on PROFINET® IO controller".
- Set the "Synchronization role" of the PLC interface which is connected to the frequency converter as **Sync Master**.
- Set the "Send clock" in the domain settings to your needs (min. 250 µs).

Setting the interface:

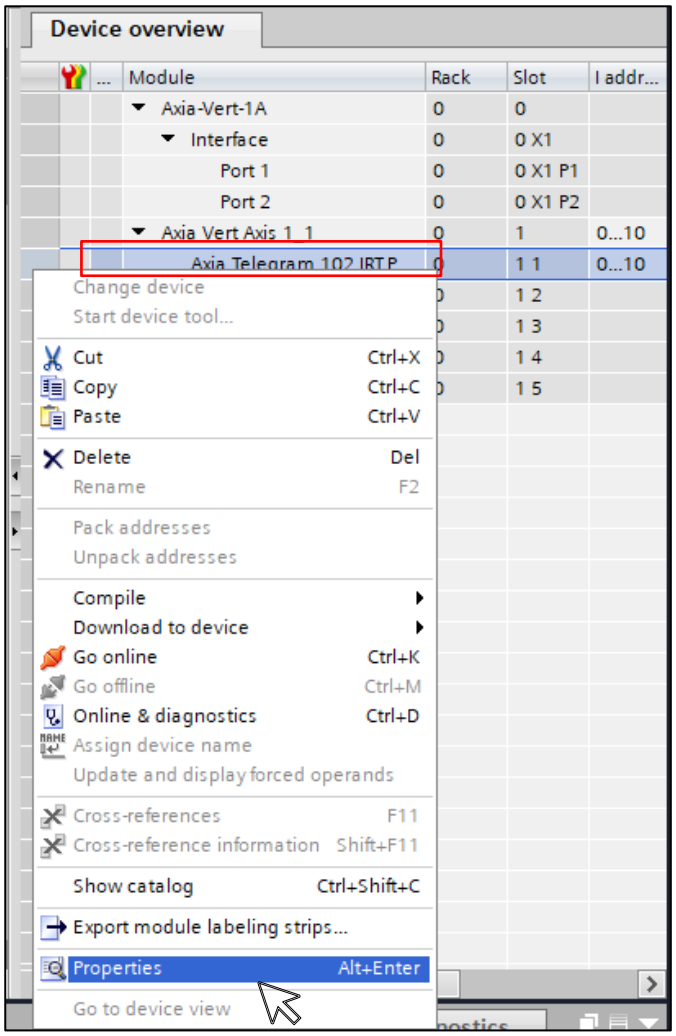


- Select "Interface" in the Device overview window.
- Go to General > Isochronous mode" and click on the "Isochronous mode" check box.



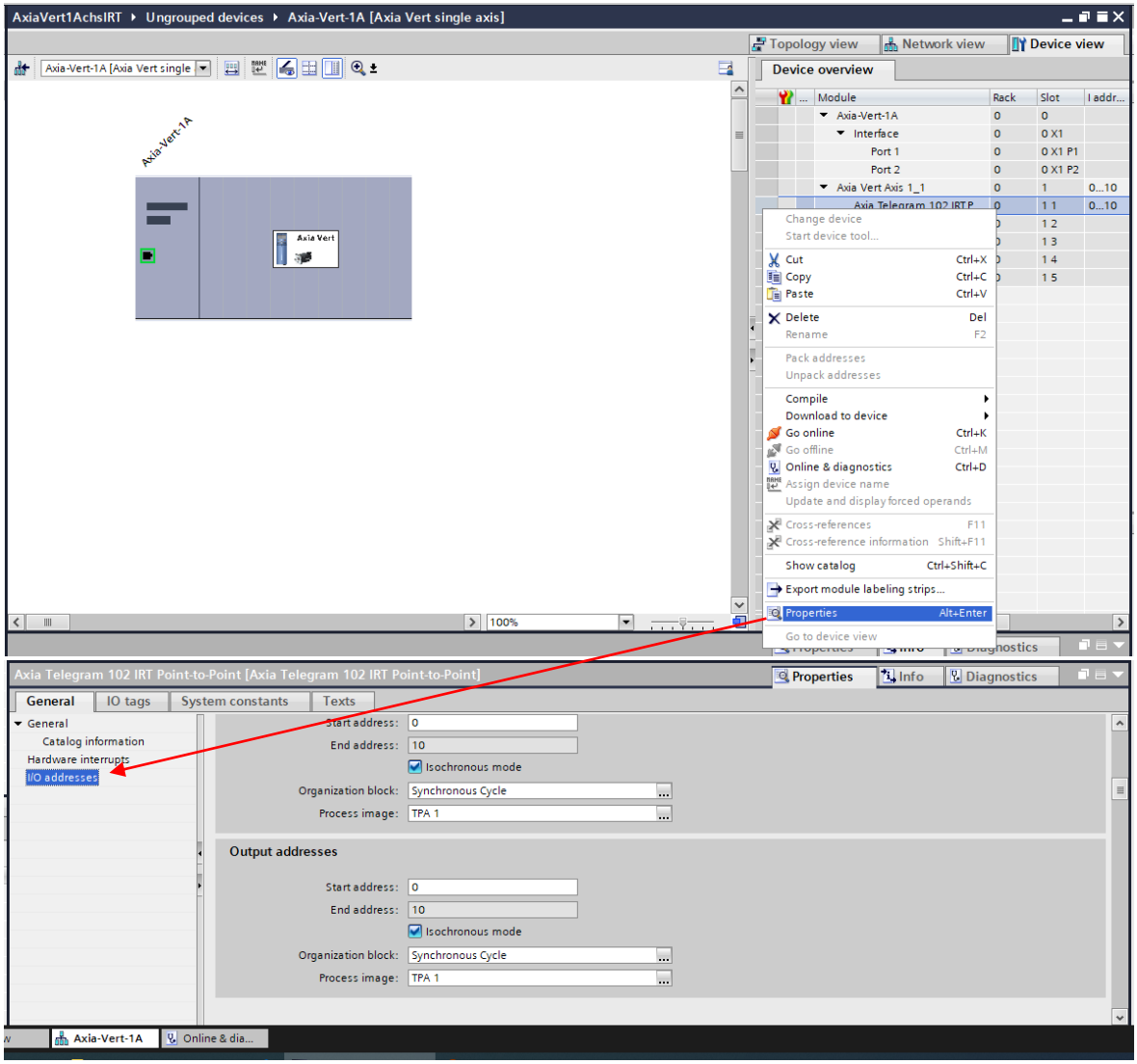
- If you are using TIA Portal V15.1 select "Manual" in the Ti/To values drop-down menu.
- If the inverter rejects the connection increase the "Time To" gradually until the connection is accepted.

Setting the telegram properties:

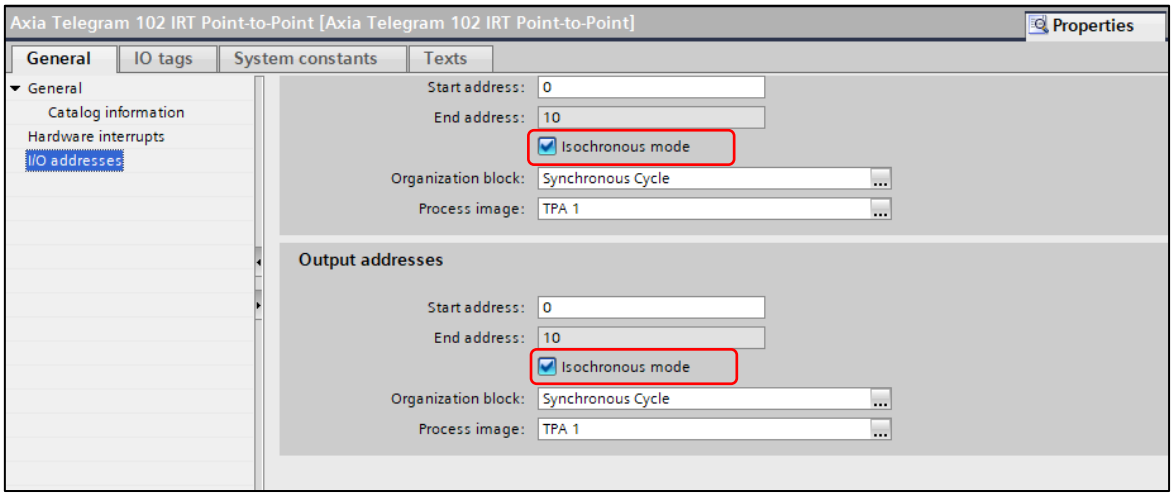


IRT1

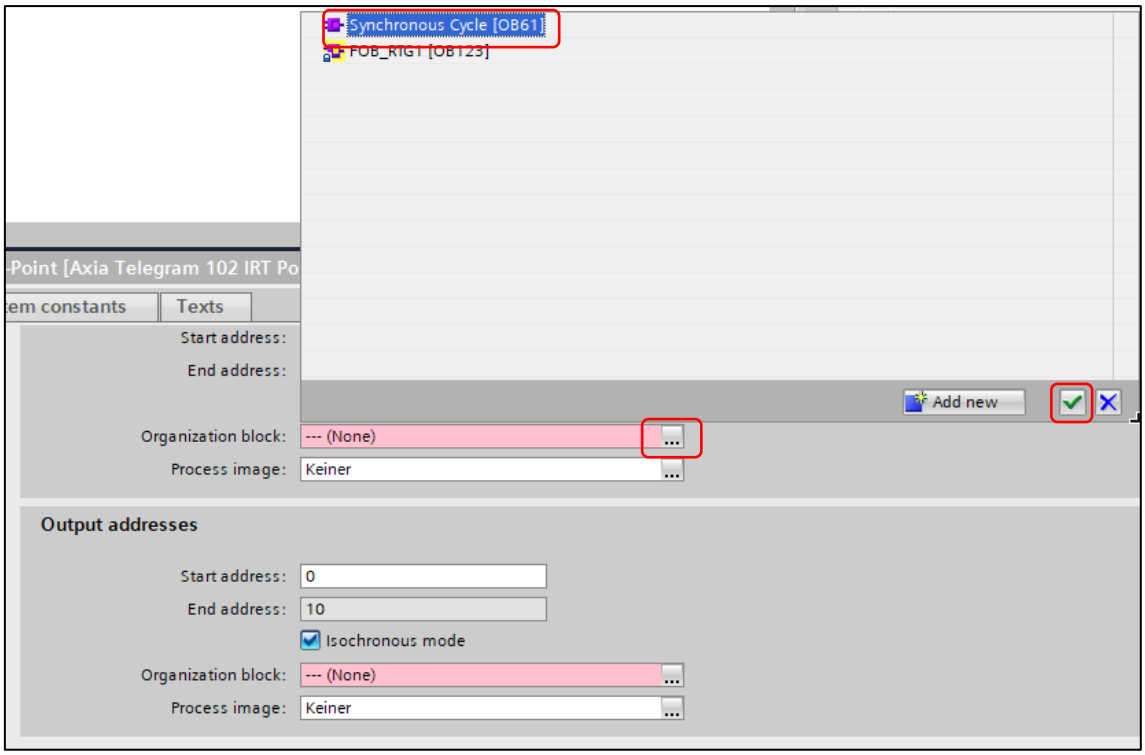
- Right-click the slot of the IRT module in the device overview and select “Properties”.



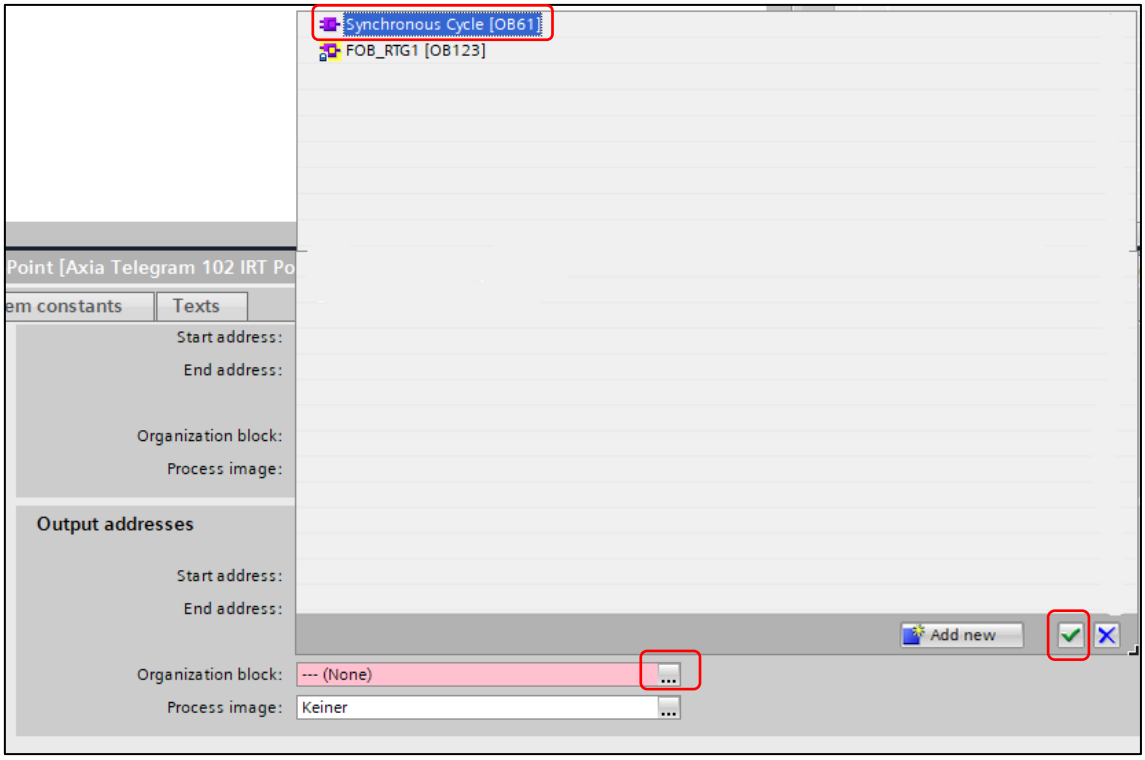
The properties window of the selected telegram is opened. The next settings are made in this window:



- Select "General > I/O addresses" in the properties window.
- Select "Isochronous mode" check box for input and output addresses.

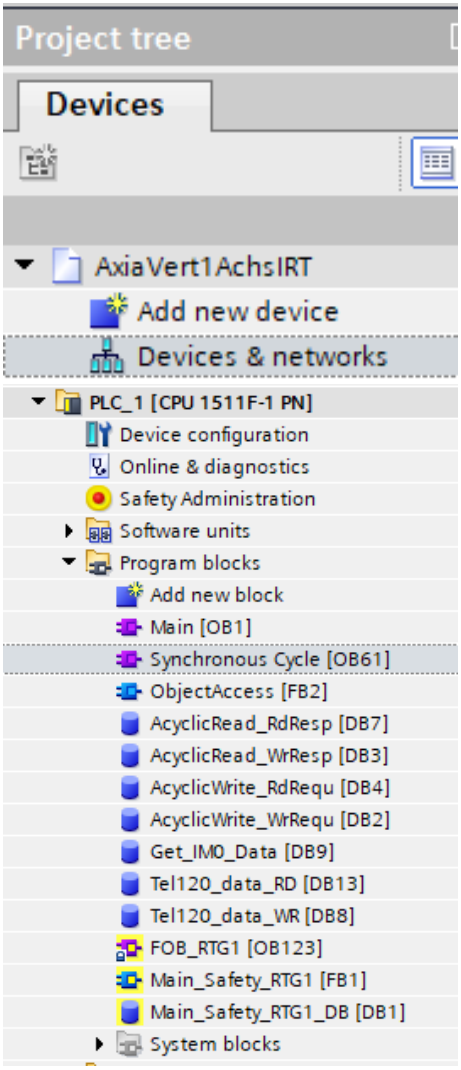


- Click on the box "…" in the Organization block drop-down menu for the input address.
- Select "Synchronous Cycle [OB61]" and click on the green tick.



- Click on the box "…" in the Organization block drop-down menu for the output address.
- Select "Synchronous Cycle [OB61]" and click on the green tick.

- If "Synchronous Cycle [OB61]" is not listed in the Organization block go to "Devices" in the Project tree window "PLC_1 [CPU 1511F-1 PN] > Program blocks > Add new block" and select "Synchronous Cycle OB61" to the project (see next figure).
- Repeat the steps in the section "Setting the telegram properties".



6.2 Available submodules

The telegrams correspond to the available submodules. The available submodules are listed in the following table:

Submodule	Telegram no.	Telegram designation	No. of output bytes	No. of input bytes
Axis-specific submodules[1)]				
Standard Telegram 1	001	Speed reference N2	4	4
Axia Telegram 101	101	Speed reference N4 (100%=2^30)	6	6
Axia Telegram 102	102	IRT Point-to-Point	11	11
Axia Telegram 104	104	IRT CSP/CSV	11	11
Axis-independent submodules[2)]				
Axia Telegram 110	110	Free Usage, Axis 1 OR Axis 2 (where applicable)	4	4
Axia Telegram 111	111	Free Usage, Axis 1 OR Axis 2 (where applicable)	4	4
Axia Telegram 112	112	Free Usage, Axis 1 OR Axis 2 (where applicable)	4	4
Axia Telegram 113	113	Free Usage, Axis 1 OR Axis 2 (where applicable)	4	4
Axia Telegram 120	120	Object access	8	8

[1)] configurable once per axis (only valid for double axis inverters)
[2)] configurable once per device

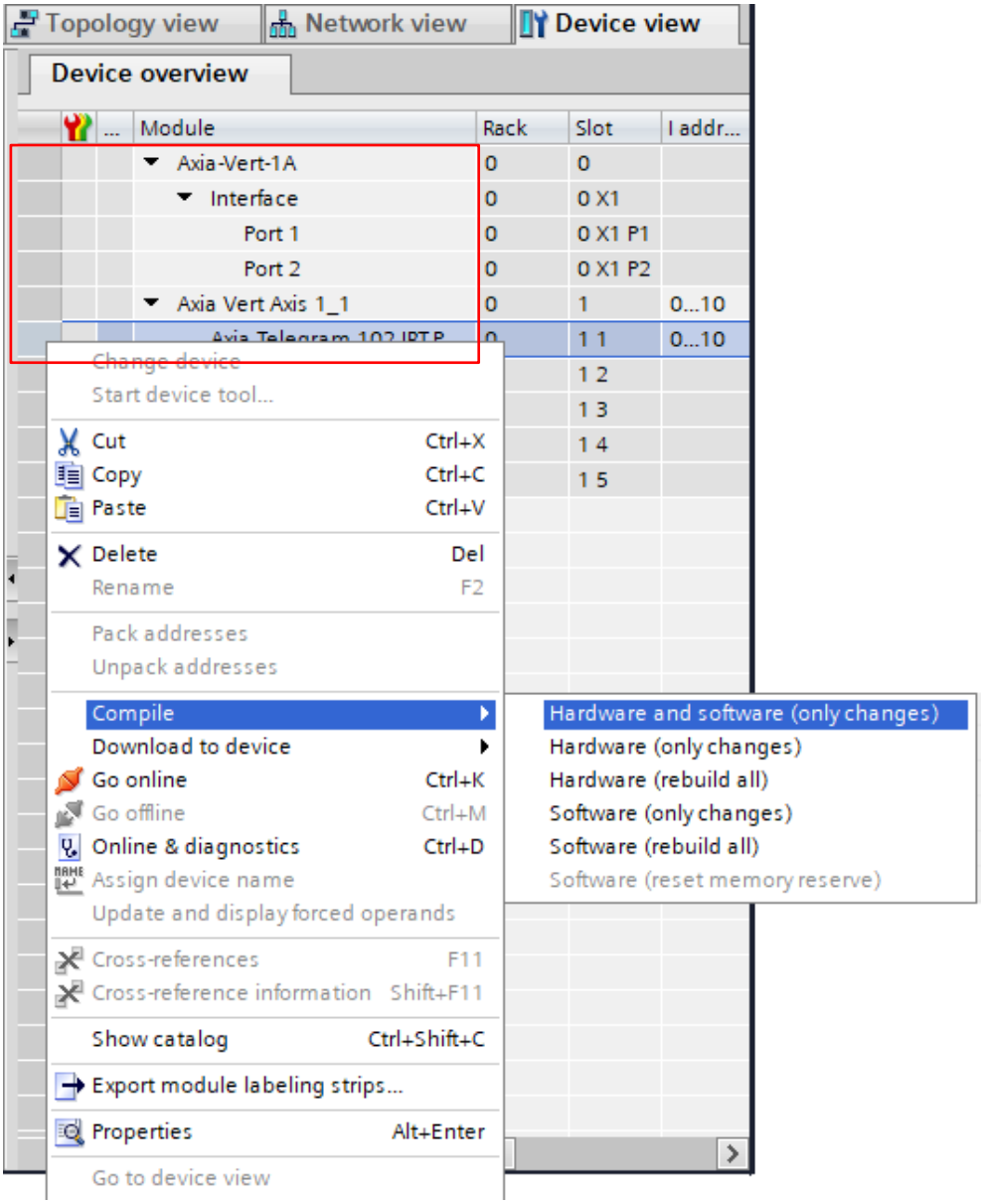
The configuration of more than one axis is only possible with *AXIA* double axis frequency inverters.

The data structure depends on the object type (axis-specific or axis-independent) and is explained in chapter 7 “Process data exchange”.

6.3 Compiling and downloading the configuration

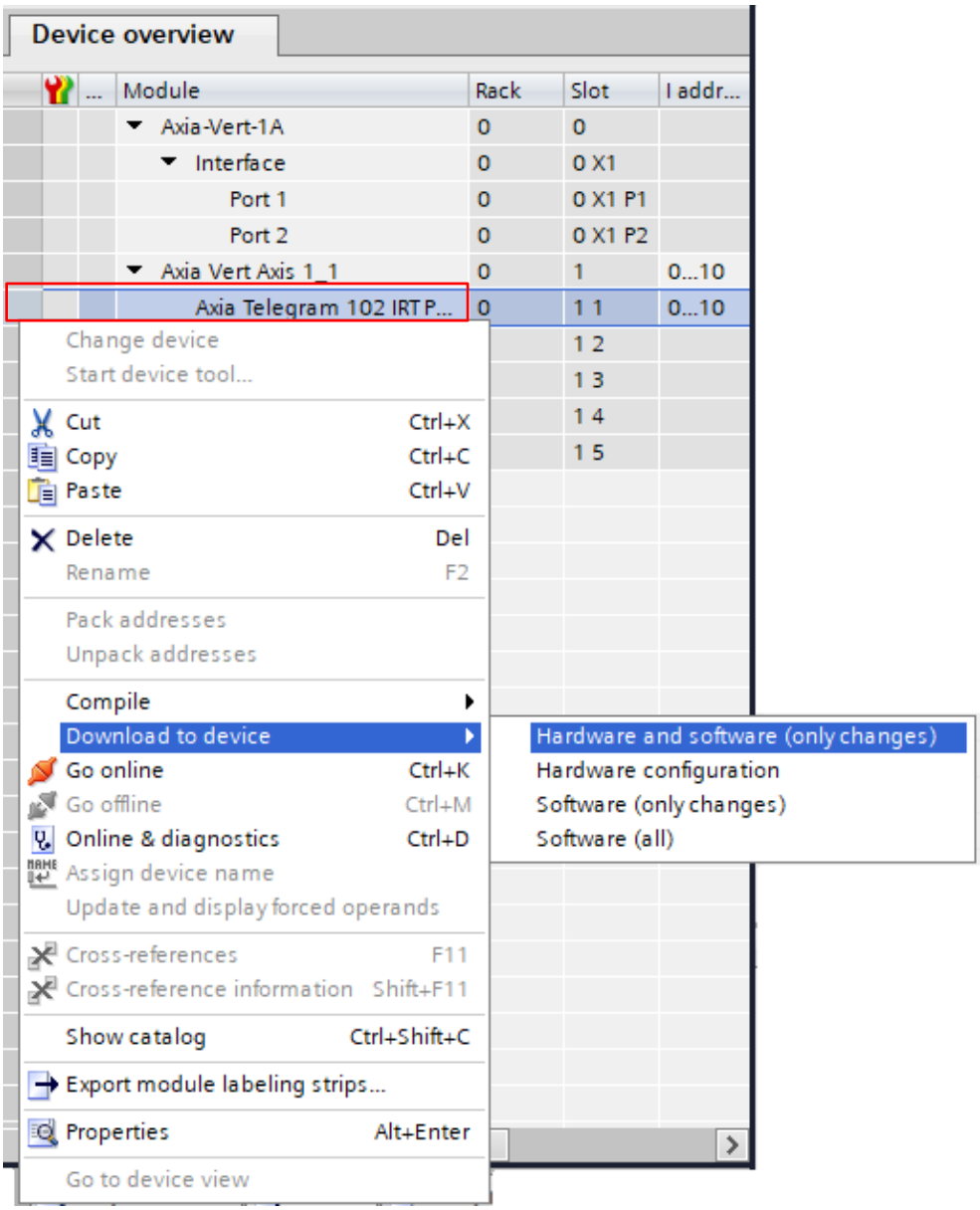
If the configuration is completed all modules must be compiled and downloaded to the device:

Compiling:



- Right-click in a free space of the module column and select "Compile > Hardware and software (only changes)".

Downloading to device:



- Right-click in a free space of the module column and select "Download to device > Hardware and Software (only changes)".

7 Process data exchange

All telegrams are configurated for the process data exchange. Telegrams 1, 101 … 104 are referenced to defined objects. The read/write process is verified by these objects.

All telegrams – except the telegrams for free usage (110 … 113) are referenced to existing CANopen (EtherCAT DS402) objects. Exception: Speed values are given as N2/N4 relative to **0x21F0/d01** … **d04** (data set 1 … 4).

7.1 Axis-specific telegrams

The objects index is valid when the axis-specific submodule is assigned to axis 1 (slot 1 in the controller). If a submodule is assigned to axis 2 (slot 2) the offset 0x0800 is added to the object index.

Example:

0x21F1 → Speed Setpoint → axis 1

0x29F1 → Speed Setpoint → axis 2

The data flow direction IN/input and OUT/output is given from the PLC's point of view.

7.1.1 Standard Telegram 1: Speed Reference N2

The standard Telegram 1 consists of two Out/In objects:

Structure of Telegram 1							
Object type	**Index**	**Sub index**	**Designation**	**Data type**	**Min. value**	**Max. value**	**Default**
Out	0x6040	0	Control word	UInt16	0	65535	0
Out	0x21F1	1	Freq. Setpoint N2	Int16	0x8000	0x7FFF	0
In	0x6041	0	Status word	UInt16	0	0	0
In	0x21F1	3	Actual Speed N2	Int16	0	0	0

The telegram comprises two word objects (4 bytes): Status word for input and control word for output. For the calculation of the reference value the object *Speed reference* **0x21F0** (axis 1) is used.

Before sending a reference speed via object **0x21F1/1** make sure that one of the speed reference objects (**0x2511** – **0x2514** *Speed Reference 1 … 4*) is set to source `0x0021F010 SRC: PROFIx Target Velocity`.

Examples:

PLC → Servo drive	
Control word	**Control word 0x6040**
0x0000	0x0000
0x0010	0x0010
0x0001	0x0001
Speed Setpoint [N2] 0x21F1/1 0x21F0/1 = 1500 rpm	**Speed reference [rpm]**
0x4000 ≙ 100% x 0x21F0/1	1500
0x7FFF ≙ 200% x 0x21F0/1	3000
0xE000 ≙ 50% x 0x21F0/1	750
0x8000 ≙ –200% x 0x21F0/1	–3000
Speed Setpoint [N2] 0x21F1/1 0x21F0/1 = 3000 rpm	**Speed reference [rpm]**
0x4000	3000
0x7FFF	6000
0xE000	1500

Servo drive → PLC	
Status word 0x6041	**Status word**
0x0040	0x0040
Actual Speed [rpm]	**Actual Speed [N2] 0x21F1/3** 0x21F0/1 = 1500 rpm
1500	0x4000
3000	0x8000
Actual Speed [rpm]	**Actual Speed [N2] 0x21F1/3** 0x21F0/1 = 1500 rpm
1500	0x4000

7.1.2 Axia Telegram 101: Speed Reference N4

The Axia Telegram 101 consists of two Out/In objects:

Structure of Telegram 101							
Object type	**Index**	**Sub index**	**Designation**	**Data type**	**Min. value**	**Max. value**	**Default**
Out	0x6040	0	Control word	UInt16	0	65535	0
Out	0x21F1	2	Speed Setpoint N4	Int32	0x80000000	0x7FFFFFFF	0
In	0x6041	0	Status word	UInt16	0	0	0
In	0x21F1	4	Actual Speed N4	Int16	0	0	0

The telegram comprises one word and one double word objects (6 bytes): Status word for input and control word for output. For the calculation of the reference value the object *Speed reference* **0x21F0** (axis 1) is used.

Examples:

PLC → Servo drive	
Control word	**Control word 0x6040**
0x0000	0x0000
0x0010	0x0010
0x0001	0x0001
Speed Setpoint [N4] 0x21F1/2 0x21F0/1 = 1500 rpm	**Speed reference [rpm]**
0x4000 ≙ 100% x 0x21F0/1	1500
0x7FFF FFFF ≙ 200% x 0x21F0/1	3000
0xE000 0000 ≙ 50% x 0x21F0/1	750
0x2222 1111 ≙ 53.33% x 0x21F0/1	799.95
Speed Setpoint [N4] 0x21F1/2 0x21F0/1 = 3000 rpm	**Speed reference [rpm]**
0x4000 0000 ≙ 100% x 0x21F0/1	3000
0x7FFF 0000 ≙ 200% x 0x21F0/1	1000
0xE000 0000 ≙ 50% x 0x21F0/1	1500
0x2222 1111 ≙ 53.33% x 0x21F0/1	1599.9

Servo drive → PLC	
Status word 0x6041	**Status word**
0x0040	0x0040
Actual Speed	**Actual Speed [N4] 0x21F1/4** 0x21F0/1 = 1500 rpm
1500	0x4000 0000
3000	0x8000 0000
Actual Speed	**Actual Speed [N4] 0x21F1/4** 0x21F0/1 = 3000 rpm
3000	0x4000 0000
6000	0x8000 0000
1599.9	0x2222 1111

7.1.3 Axia Telegram 102: IRT (Isochronous Real Time) Point-to-Point

The Axia Telegram 102 consists of four Out/In objects each:

Structure of Telegram 102							
Object type	**Index**	**Sub index**	**Designation**	**Data type**	**Min. value**	**Max. value**	**Default**
Out	0x6040	0	Control word	UInt16	0	65535	0
Out	0x6081	0	Profile velocity	UInt32	0	0x7FF FFFFF	0x50000
Out	0x607A	0	Target position	Int32	0x8000000	0x7FF FFFFF	0
Out	0x6060	0	Mode of operation	Int8	No list	Mode of Operation SM	No Mode (drive stopped) [1)]
In	0x6041	0	Status word	UInt16	0	0	0
In	0x606C	0	Velocity actual value	Int16	0	0	0
In	0x6064	0	Position actual value	Int32	0	0	0
In	0x6061	0	Mode of operat. display	Int8	No list	Mode of Operation All	No Mode (drive stopped) [1)]

[1)] see list with possible values:

The following values are possible with objects **0x6060** and **0x6061**:

0x6060	Possible Out values		0x6061	Possible In values
0x0000 0000	No Mode (Drive stopped)		0x0000 0000	No Mode (Drive stopped)
0x0000 0001	Profile position mode (1)		0x0000 0001	Profile position mode
0x0000 0002	Velocity mode (2)		0x0000 0002	Velocity mode
0x0000 0003	Profile velocity mode (3)		0x0000 0003	Profile velocity mode
0x0000 0004	Torque profile mode (4)		0x0000 0004	Torque profile mode
0x0000 0005	Reserved (5)		0x0000 0005	Reserved
0x0000 0006	Homing mode (6)		0x0000 0006	Homing mode
0x0000 0007	Interpolated position mode (7)		0x0000 0007	Interpolated position mode
0x0000 0008	Cyclic Synchronous position (8)		0x0000 0008	Cyclic Synchronous position
0x0000 0009	Cyclic Synchronous velocity (9)		0x0000 0009	Cyclic Synchronous velocity
0x0000 000A	Cyclic Synchronous torque (10)		0x0000 000A	Cyclic Synchronous torque
0xFFFF FFF6	Axia Automatic tuning (-10)		0xFFFF FFF6	Axia Automatic tuning
			0xFFFF FFFA	Axia Jog mode
0xFFFF FFFB	Axia Speed control (-5)		0xFFFF FFFB	Axia Speed control
0xFFFF FFFC	Axia Torque control (-4)		0xFFFF FFFC	Axia Torque control
0xFFFF FFFD	Axia Electronic gear (-3)		0xFFFF FFFD	Axia Electronic gear
0xFFFF FFFE	Axia Move away from limit switches (-2)		0xFFFF FFFE	Axia Move away from limit switches
0xFFFF FFFF	Axia Table travel record (-1)		0xFFFF FFFF	Axia Table travel record

= default setting

Examples:

PLC → Servo drive

Control word	Control word 0x6040
0x0000	0x0000
0x0010	0x0010
0x0001	0x0001
Profile Velocity	**Profile Velocity 0x6081**
0x4000 0000	0x4000 0000
0x8000 0000	0x8000 0000
0xE000 1111	0xE000 1111
Target Position	**Target Position 0x607A**
0x4000 0000	0x4000 0000
0x8000 0000	0x8000 0000
0xE000 1111	0xE000 1111
Mode-of-Operation	**Mode-of-Operation 0x6060**
2	2
8	8

7.1.4 Axia Telegram 104: IRT CSP/CSV (Cyclic Synchronous Position/ Velocity)

In order to use this telegram, the controller must be set as Sync Master. See chapter 6.1.1 "Configuration process for IRT submodules" for further instructions.

The Axia Telegram 104 consists of four Out/In objects each:

Structure of Telegram 101							
Object type	**Index**	**Sub index**	**Designation**	**Data type**	**Min. value**	**Max. value**	**Default**
Out	0x6040	0	Control word	UInt16	0	65535	0
Out	0x60FF	0	Target velocity	Int16	0x800	0x7FFF	0x5000
Out	0x607A	0	Target position	Int32	0x8000000	0x7FFF FFFF	0
Out	0x6060	0	Mode of operation	Int8	No list	Mode of Operation SM	No Mode (drive stopped) [1)]
In	0x6041	0	Status word	UInt16	0	0	0
In	0x606C	0	Velocity actual value	Int16	0	0	0
In	0x6064	0	Position actual value	Int32	0	0	0
In	0x6061	0	Mode of operat. display	Int8	No list	Mode of Operation All	No Mode (drive stopped) [1)]

[1)] see list with possible values:

The following values are possible with objects **0x6060** and **0x6061**:

0x6060	**Possible Out values**		**0x6061**	**Possible In values**
0x0000 0000	No Mode (Drive stopped)		0x0000 0000	No Mode (Drive stopped)
0x0000 0001	Profile position mode (1)		0x0000 0001	Profile position mode
0x0000 0002	Velocity mode (2)		0x0000 0002	Velocity mode
0x0000 0003	Profile velocity mode (3)		0x0000 0003	Profile velocity mode
0x0000 0004	Torque profile mode (4)		0x0000 0004	Torque profile mode
0x0000 0005	Reserved (5)		0x0000 0005	Reserved
0x0000 0006	Homing mode (6)		0x0000 0006	Homing mode
0x0000 0007	Interpolated position mode (7)		0x0000 0007	Interpolated position mode
0x0000 0008	Cyclic Synchronous position (8)		0x0000 0008	Cyclic Synchronous position
0x0000 0009	Cyclic Synchronous velocity (9)		0x0000 0009	Cyclic Synchronous velocity
0x0000 000A	Cyclic Synchronous torque (10)		0x0000 000A	Cyclic Synchronous torque
0xFFFF FFF6	Axia Automatic tuning (-10)		0xFFFF FFF6	Axia Automatic tuning
			0xFFFF FFFA	Axia Jog mode
0xFFFF FFFB	Axia Speed control (-5)		0xFFFF FFFB	Axia Speed control
0xFFFF FFFC	Axia Torque control (-4)		0xFFFF FFFC	Axia Torque control
0xFFFF FFFD	Axia Electronic gear (-3)		0xFFFF FFFD	Axia Electronic gear
0xFFFF FFFE	Axia Move away from limit switches (-2)		0xFFFF FFFE	Axia Move away from limit switches
0xFFFF FFFF	Axia Table travel record (-1)		0xFFFF FFFF	Axia Table travel record

= default setting

7.2 Axis-independent telegrams

These telegrams can be used application-specifically. In the frequency inverter, these objects are represented as sources for output objects (data received from PROFINET® controller) and as input objects for sources (data to be sent to PROFINET® controller).

Each axis-independent object comprises two word objects (4 bytes).

The data flow direction IN/input and OUT/output is given from the PLC's point of view.

OUT (PLC to frequency inverter) → Sources

Byte	Source no.[1)]	**Word**	Double word
Byte 0	-	Word 0	Long 0
Byte 1	-		
Byte 2	-	Word 1	
Byte 3	-		

[1)] The byte sources are not implemented because no byte objects exist.

The following data types exist for the sources "Word" and "Double word".

uint16/int16/uint32/int32/float32

IN (frequency inverter to PLC) → input objects

Byte	Index/ Sub index	**Word**	Index/ Sub index	**Double word**	Index/ Sub index
Byte 0	-	Word 0		Long 0	
Byte 1	-				
Byte 2	-	Word 1			
Byte 3	-				

[1)] The byte inputs are not implemented because no byte objects exist.

The following objects exist for the following data sizes:

Word/Double word

No distinction is made according to data type. The data type depends on the linked source and is to be considered accordingly in the PLC program.

7.2.1 Axia Telegram 110

Telegram 110 is for free usage. The Axia Telegram 110 consists of four resp. two In/Out objects. Two Uint16 for In and two Uint16 for Out, or one Uint32 for In and one Uint32 for Out. They are entered respectively displayed in the following Uint32 objects:

Structure of Telegram 110

Object type	**Index**	**Sub index**	**Designation**	**Data type**	**Min. value**	**Max. value**	**Default**
In	0x3916	10	Variable data In	UInt32	0	0	0
Out	0x3916	20	Variable data Out	UInt32	0	0xFFFF FFFF	0

Content selection (mapping) can be made by the following objects, e.g.:

Index	**0x3915, ...**		
Sub index	**... /17** [1)] (2 byte)	**... /19** [2)] (2 byte)	**... /33** [3)] (4 byte)
Source no.	0x391618	0x391619	0x391620
Data type	Uint16	Uint16	Uint32 (DWORD)

1) The first 2 bytes in the telegram are only possible if the value of sub index 33 is 0.
2) The second 2 bytes in the telegram are only possible if the value of sub index 33 is 0.
3) All 4 bytes in the telegram are only possible if the values of sub indexes 17 and 19 are 0.

The following values are possible:

0x3915/17	Possible values
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word
0x3915/19	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word
0x3915/33	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0004	SRC: Hundred
0x0039 1020	SRC: SB RxPDO1 UInt32 0
0x0039 8000	SRC: MF Analog Input 1
0x0039 8010	SRC: MF Analog Input 2
0x0059 0000	SRC: DC-Link voltage

= default setting

7.2.2 Axia Telegram 111

Telegram 111 is for free usage. The Axia Telegram 111 consists of four resp. two In/Out objects. Two Uint16 for In and two Uint16 for Out, or one Uint32 for In and one Uint32 for Out. They are entered respectively displayed in the following Uint32 objects:

Structure of Telegram 111

Object type	Index	Sub index	Designation	Data type	Min. value	Max. value	Default
In	0x3916	11	Variable data In	UInt32	0	0	0
Out	0x3916	21	Variable data Out	UInt32	0	0xFFFF FFFF	0

Content selection (mapping) can be made by the following objects, e.g.:

Index	**0x3915, ...**		
Sub index	**... /81** [1] (2 byte)	**... /83** [2] (2 byte)	**... /97** [3] (4 byte)
Source no.	0x391668	0x391669	0x391670
Data type	Uint16	Uint16	Uint32 (DWORD)

1) The first 2 bytes in the telegram are only possible if the value of sub index 97 is 0.
2) The second 2 bytes in the telegram are only possible if the value of sub index 97 is 0.
3) All 4 bytes in the telegram are only possible if the values of sub indexes 81 and 83 are 0.

The following values are possible:

0x3915/81	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word
0x3915/83	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word
0x3915/97	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0004	SRC: Hundred
0x0039 1020	SRC: SB RxPDO1 UInt32 0
0x0039 8000	SRC: MF Analog Input 1
0x0039 8010	SRC: MF Analog Input 2
0x0059 0000	SRC: DC-Link voltage

= default setting

7.2.3 Axia Telegram 112

Telegram 112 is for free usage. The Axia Telegram 112 consists of four resp. two In/Out objects. Two Uint16 for In and two Uint16 for Out, or one Uint32 for In and one Uint32 for Out. They are entered respectively displayed in the following Uint32 objects:

Structure of Telegram 112

Object type	Index	Sub index	Designation	Data type	Min. value	Max. value	Default
In	0x3916	12	Variable data In	UInt32	0	0	0
Out	0x3916	22	Variable data Out	UInt32	0	0xFFFF FFFF	0

Content selection (mapping) can be made by the following objects, e.g.:

Index	**0x3915, ...**		
Sub index	**... /145** [1] (2 byte)	**... /147** [2] (2 byte)	**... /161** [3] (4 byte)
Source no.	0x3916B8	0x3916B9	0x3916C0
Data type	Uint16	Uint16	Uint32

1) The first 2 bytes in the telegram are only possible if the value of sub index 161 is 0.
2) The second 2 bytes in the telegram are only possible if the value of sub index 161 is 0.
3) All 4 bytes in the telegram are only possible if the values of sub indexes 145 and 147 are 0.

The following values are possible:

0x3915/145	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word
0x3915/147	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word

0x3915/161	Possible values
0x0000 0000	SRC: 0 / null / false / none
0x0000 0004	SRC: Hundred
0x0039 1020	SRC: SB RxPDO1 UInt32 0
0x0039 8000	SRC: MF Analog Input 1
0x0039 8010	SRC: MF Analog Input 2
0x0059 0000	SRC: DC-Link voltage

= default setting

7.2.4 Axia Telegram 113

Telegram 113 is for free usage. The Axia Telegram 113 consists of four resp. two In/Out objects. Two Uint16 for In and two Uint16 for Out, or one Uint32 for In and one Uint32 for Out. They are entered respectively displayed in the following Uint32 objects:

Structure of Telegram 113							
Object type	**Index**	**Sub index**	**Designation**	**Data type**	**Min. value**	**Max. value**	**Default**
In	0x3916	13	Variable data In	UInt32	0	0	0
Out	0x3916	23	Variable data Out	UInt32	0	0xFFFF FFFF	0

Content selection (mapping) can be made by the following objects, e.g.:

Index	**0x3915, ...**		
Sub index	**... /209** [1] (2 byte)	**... /211** [2] (2 byte)	**... /225** [3] (4 byte)
Source no.	0x3916F8	0x3916F9	0x391700
Data type	Uint16	Uint16	Uint32

1) The first 2 bytes in the telegram are only possible if the value of sub index 225 is 0.
2) The second 2 bytes in the telegram are only possible if the value of sub index 225 is 0.
3) All 4 bytes in the telegram are only possible if the values of sub indexes 209 and 211 are 0.

The following values are possible:

0x3915/209	Possible values
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word

0x3915/211	Possible values
0x0000 0000	SRC: 0 / null / false / none
0x0000 0005	SRC: Debug Sine
0x0021 B000	SRC: Multiplexer Output
0x0039 1018	SRC: SB RxPDO1 UInt 16 0
0x0039 1019	SRC: SB RxPDO1 UInt 16 1
0x0039 101A	SRC: SB RxPDO1 UInt 16 2
0x0039 101B	SRC: SB RxPDO1 UInt 16 3
0x0039 1618	SRC: PROFIx Tel110/PD1 RX ui16_0
0x0039 1619	SRC: PROFIx Tel110/PD1 RX ui16_1
0x0039 1668	SRC: PROFIx Tel111/PD2 RX ui16_0
0x0039 1669	SRC: PROFIx Tel111/PD2 RX ui16_1
0x0039 16B8	SRC: PROFIx Tel112/PD3 RX ui16_0
0x0039 16B9	SRC: PROFIx Tel112/PD3 RX ui16_1
0x0039 16FC	SRC: PROFIx Tel113/PD4 RX ui16_0
0x0039 16FD	SRC: PROFIx Tel113/PD4 RX ui16_1
0x0060 4000	SRC: Control Word
0x0060 4100	SRC: Status Word
0x3915/225	**Possible values**
0x0000 0000	SRC: 0 / null / false / none
0x0000 0004	SRC: Hundred
0x0039 1020	SRC: SB RxPDO1 UInt32 0
0x0039 8000	SRC: MF Analog Input 1
0x0039 8010	SRC: MF Analog Input 2
0x0059 0000	SRC: DC-Link voltage

= default setting

7.2.5 Axia Telegram 120: Object access

The object access is used for reading and writing access to addressed frequency inverter objects. All objects excluding the string objects can be written/read. The object access produces additional bus load because it sends its contents with each data exchange cycle, no matter if it is actually needed or not. As an alternative to the object access, the module CMA-IE-01-PN supports asynchronous read and write access. See chapter 8.2.

Object access over process data is realized by use of Telegram 120: This telegram has the following structure:

Designation	Index	Sub index	Object code	Data type	Min. value	Max. value	Default
Tel120/ObjAccess In (Tx)	0x3916	30	Record	UInt64	0	0	0
Tel120/ObjAccess Out (Rx)	0x3916	31	Record	UInt64	0	0xFFFF FFFF FFFF FFFF	0

Each object contains two Word data type input and output objects. The process data exchange takes place via an 8-byte telegram.

OUT/Request (PLC → inverter) **IN/Response (inverter → PLC)**

Byte	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
			MSB	LSB				
	cmd	**SubIdx**	**Index**		**data**			
	ATTENTION: Data is located in the „data" part in Big-Endian format! see here →				uint8/int8			
					MSB	LSB		
					uint16/int16			
					MSB			LSB
					uint32/int32/float			

Structure "cmd"

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
request	**v**	**r/w**	x	x	x	**n**	**n**	**n**
response	**v**	**r/w**	E	x	x	**n**	**n**	**n**

v valid
0 → telegram not valid
1 → telegram valid

r/w read/write
0 → read command
r/w is reported back in "response"
1 → write command

E Error
0 → no fault response
1 → fault response, error code in "data" (4 Bytes)

nnn valid data bytes in "data" (1, 2 or 4)

Values for "data", "index" and "sub index" are set first, then the value for "cmd".

Cmd =
0x80 valid/read
0xC1 valid/write/1 Byte
0xC2 valid/write/2 Bytes
0xC4 valid/write/4 Bytes

0x00 clear channel
(response: IN cmd = 0x00)

The write operation in telegram 120 is volatile. Written values are not stored in the EEPROM.

Object values (= data) of type Integer/Unsigned Integer (16 Bit) and Long (32 Bit) can be written and read. The data type is specified in the order ID. In the case of data set switchable objects (array), the required data set is given under the index byte (byte 2).

8 Handling of Objects

The available objects are marked with "index" and "sub index" and must be addressed via this ID. The following definitions apply:

Access type			
Read only	The PLC can only read data from the frequency inverter.		
Read/Write	The PLC is granted unlimited access (reading and writing) to the frequency inverter data.		
Data type			
UInt64	64 Bit value:	$0…2^{64}$-1 0…0xFFFF FFFF FFFF FFFF	
UInt32	32 Bit value:	$0…2^{32}$-1 0…0xFFFF FFFF	
UInt16	16 Bit value:	$0…2^{16}$-1 0…0x FFFF	(0…65535)
UInt8	8 Bit value:	$0…2^{8}$-1 0…0xFF	(0…255)
Int32	Signed 32 Bit value	$-2^{31}…2^{31}$-1 0x8000 0000…0x7FFF FFFF	
Int16	Signed 16 Bit value:	$2^{15}…2^{15}$-1 0x8000…0x7FFF	(-32768…32767)
Int8	Signed 8 Bit value:	$2^{7}…2^{7}$-1 0x80…0x7F	(-128…127)

"Highest sub index supported" shows the highest sub index supported by the object.

Object Grouping

Every object is addressed via a 16 Bit index, which is displayed as a 4-digit hexadecimal number.

The object indexes in this chapter are sorted in groups according to the PROFINET® functions:

Cyclic data exchange:
- Process data objects
- Mapping objects

Acyclic objects:
- Information and maintenance objects

Devices/network diagnostics:
- Diagnostics
- Operating behavior in the case of bus connection failure
- Resetting errors

Process data objects can be subdivided in axis-specific objects versus axis-independent objects. There is an offset of 0x0800 per axis in the axis-specific range.

Axis-specific object ranges (with reference to DS402 objects 0x6nnn):
- 0x6000 – 0x60FF (axis 1)
- 0x6800 – 0x68FF (axis 2)
- 0x21F1 (1 – 4) for speed reference rescaling

Axis-independent object range:
- 0x3915 – 0x3916

8.1 Process data objects

8.1.1 PROFINET® output sources

In the table below, the available PLC output sources of the objects are listed. The content of the sources depends on the application. For the different data types, the relevant sources must be linked to the input objects of the frequency inverter.

- Availability of output sources depends on the number of configured objects.
- Each configured object comprises either two Boolean, two Word or one Long output object(s).
- An output object can only be used for one data type (depending on the application requirements).
- The first object configured (obligatory) represents telegram 1/110 with fixed contents and functions.

Object			Value setting	
Object no.	**Telegram no.**	**Designation**	**Min. value**	**Max. value**
0x6040/00	1, 101, 102, 104	Control word	0	0xFFFF (65535)
0x21F1/01	1	Speed Setpoint N2	0x8000 (-32768)	0x7FFF (32767)
0x21F1/02	101	Speed Setpoint N4	0x8000 0000 (-2147483648)	0x7FFF FFFF (2147483647)
0x6081/00	102	Profile velocity	0	0x7FFF
0x607A/00	102, 104	Target position	0x8000 0000	0x7FFF FFFF
0x6060/00	102, 104	Mode of operation	No list	Mode of Operation SM
0x60FF/00	104	Target velocity	0x8000 0000	0x7FFF FFFF
0x3916/20 – 0x3916/23	110 – 113	PD1 ActValue Out (Rx)	0	0xFFFF FFFF
0x3916/31	120	ObjAccess Out (Rx)	0	0xFFFF FFFF FFFF FFFF

Each source can be linked to an input object of the frequency inverter of the same data type.

The objects will be described as follows:

Object		Value setting		
Index/sub index	**Designation**	**Min. value**	**Max. value**	**Default**
0xabcd/xyz	Object name	0	65536	0

Example:

Object		Value setting	
Index/sub index	**Designation**	**Value**	**Designation**
0x3916/20	Variable data Out	0x3BA302	PLC inputs

8.1.2 PROFINET® input sources

In the table below, the available input sources of the input objects are listed. The content of the sources depends on the application. For the different data types, the relevant input objects must be linked to the sources of the frequency inverter.

- Availability of input sources depends on the number of configured objects.
- Each configured object comprises either two Boolean, two Word or one Long input object(s).
- An input object can only be used for one data type (depending on the requirements of the application).
- The first object configured (obligatory) represents telegram 1/110 with fixed contents and functions.

Object			Value setting	
Object no.	**Telegram no.**	**Designation**	**Min. value**	**Max. value**
0x6041/00	1, 101, 102, 104	Status word	0	0
0x6044/01	1	Actual speed N2	0	0
0x6044/01	101	Actual speed N4	0	0
0x606C/00	102, 104	Velocity actual value	0	0
0x6064/00	102, 104	Position actual value	0	0
0x6061/00	102, 104	Mode of operat. display	No list	Mode of Operation All
0x3915/17 – 0x3915/225	110 – 113	PD1 Tx – PD4 Tx	0	0
0x3916/10 – 0x3916/13	110 – 113	PD1 ActValue In (Tx) – PD4 ActValue In (Tx)	0	0
0x3916/30	120	ObjAccess In (Tx)	0	0

When an object is set to a certain source, it must be ensured that the relevant objects have the preset values at the same place.

The objects will be described as follows:

Object		Value setting		
Index/sub index	**Designation**	**Min. value**	**Max. value**	**Default**
0xabcd/xyz	Object name	0	65536	0

Example:

Object		Value setting	
Index/sub index	**Designation**	**Value**	**Designation**
0x3915/33	Tel110/PD1 Tx	0x0039 8000	SRC: MF Analog Input 1

Current standardization

Standardization			
Reference Value	**Binary**	**Decimal**	**Hexadecimal**
+ 100%	+ 2^{14}	16384	0x4000

Possible range = ±200% = +32768 to -32768 = 0x8000 through 0x7FFF

For internal standardization, the data set switchable object *Rated Current* **0x2003** is used as the reference value.

Objects		Settings		
No.	**Description**	**Min.**	**Max.**	**Factory setting**
0x2003	Rated current	0.01 · I_{FUN}	10 · I_{FUN}	I_{FUN}

8.2 Devices/Network Diagnostics

8.2.1 Diagnostics

The diagnostics function reports incoming/outgoing alarms. If a failure occurs the device triggers and acknowledges an alarm.

Relevant components for the data block:

Additional_Diag	Struct
header	Struct
BlockType	Word
BlockLength	UInt
Version	Word
InterruptType	UInt
API	DWord
SlotNumber	UInt
SubSlotNumber	UInt
ModulSpecInfo	DWord
SubmodulSpecInfo	DWord
InterruptSpecifier	Word
addInfo	Struct
FormatIdentifier	Word
ChannelNumber	Word
ChannelErrorType	Byte
DataFormat	Byte
ErrorCode	Word

header\InterruptType	= 1: incoming incident (occurring error)
	= 12: outgoing incident (error acknowledgment)
header\InterruptSpecifier	= counter, will be incremented with each incident
addInfo\FormatIdentifier	= 0x8000 (ChannelInfo) incoming incident
addInfo\ErrorCode	= inverter error no.

For the evaluation of diagnostic messages, the organization block OB82 must be present in the controller project. OB82 will be activated with an incoming diagnostic message (alarm interrupt). The function **RALRM** (Read alarm) must be executed within OB82. For the evaluation of the diagnostic messages the Hardware Identifier is relevant.

An outgoing event (acknowledge fault) is not deleted automatically. The data already read must be deleted in the data block before **RDALRM** is activated.

8.2.2 Operating behavior in the case of bus connection failure

The operating behavior in the case of failure of the PROFINET® systems can be parameterized. The required behavior can be set via the object **0x6007/0** *Abort conn. option code* and **0x605E/0** *Fault reaction option code*.

Abort conn. option code 0x6007		Function
0x00000000	No Action	Operating point is maintained
0x00000001	Fault Signal **Default**	"Fault" status will be activated immediately. **Factory setting**.
0x00000002	Disable Voltage Command	Control command "Disable voltage" and switch to "switch on disabled" status.
0x00000003	Quick Stop Command	Control command "Quick stop" and switch to "switch on disabled" status.
0xFFFFFFFE	Slow Down Ramp, Fault	
0xFFFFFFFF	Quick Down Ramp, Fault	

Fault reaction option code 0x605E		Function
0x00000000	Disable drive function	Drive functions will be disabled directly.
0x00000001	Slow Down on Slow Down Ramp	
0x00000002	Slow Down on Quick Stop Ramp **Default**	

If the *Abort conn. option code* is set to "Fault signal" the PLC reacts according to the setting in the *Fault reaction option code*. In all other settings the reaction is directly according to *Abort conn. option code*.

8.2.3 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** = `3 - Statemachine`:
- Set bit 7 of control word telegram 1 = 0x8000.
- By pressing the STOP button of the control panel (only possible if object *Control Mode* **0x2200** permits control via the control panel = `2 - Keypad`).
- Via object *Fault Reset* **0x2102** which is assigned a logic signal or a digital input.

A reset via a digital signal can only be carried out when object *Control Mode* **0x2200** permits this.

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).

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