Bonfiglioli Vectron

AXIA VERT

Communication Module Manual
CMA-485-01 for MODBUS
CMA-232-01 for MODBUS

Frequency inverter 230 V / 400 V
0,25 kW ... 15 kW

Bonfiglioli

TABLE OF 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 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-232-01/CMA-485-01 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 communication module CMA-232-01/CMA-485-01 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.

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 AXIA series, the following documentation must be complied with:

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

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

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.

1.5 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,
- 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.

When LEDs and other indicating elements on the frequency inverter go out, this does not necessarily mean that the device is deenergized. Before carrying out any Work at the device where contact with energized parts might be possible, it must be checked in any case, i.e.

irrespective of the status of any indicating elements that may be installed, if the device is deenergized.

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

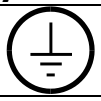
2.6.4 Personal safety equipment

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 number
/d01	bold, underlined	Representation of data set number
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 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

This document describes the communication module CMA-232-01/CMA-485-01. For the RS485 connection, the frequency inverter must be equipped with the RS485 communication module CMA-485-01. For the RS232 connection, the frequency inverter must be equipped with the RS232 communication module CMA-232-01. This is described in detail in chapter "Installation".

This document only describes the communication module CMA-232-01/CMA-485-01. It does not provide basic information on the serial interfaces RS485 and RS232. Neither does it contain any basic information on the operation of the frequency inverter.

Basic knowledge of the methods and function of the RS485 and RS232 serial interface and Modbus protocol is required in order to understand and use the instructions contained in this document.

RS485 connection

The frequency inverter can be connected to a EIA-485 bus system by extension with CMA-485-01 communication modules. The bus structure is linear and designed as a 2-wire line. Via a bus master, up to 30 frequency inverters can be addressed.

The frequency inverters can be parameterized and controlled easily. Additionally, frequency inverter data can be polled and setting commands can be transmitted during operation via the bus system by means of a PC or a PLC.

RS232 connection

The RS232 connection enables a peer-to-peer connection between two clients.

4 Installation/Disassembly of the communication module

The CMA-232-01/CMA-485-01 communication module is delivered in a separate case ready for assembly.

4.1 Installation

CAUTION

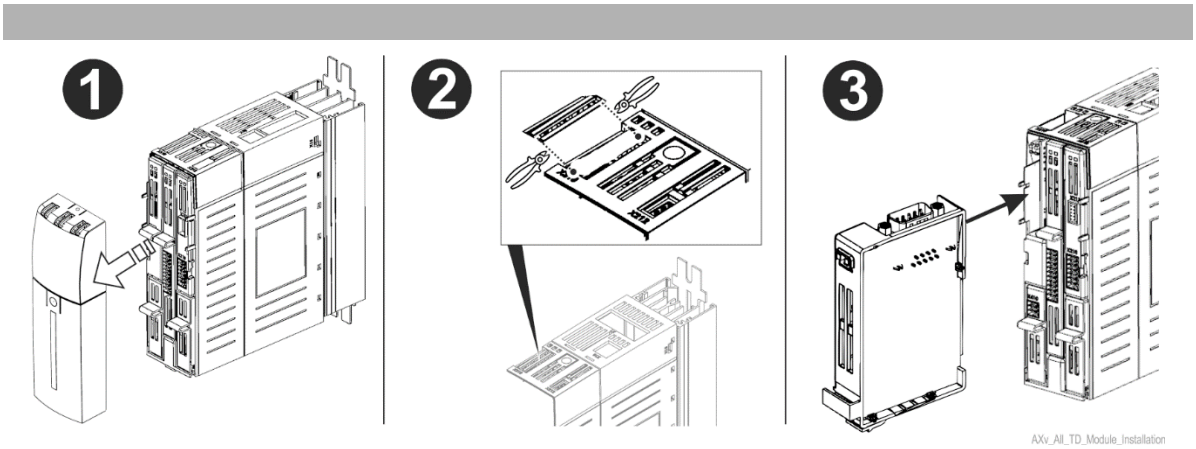
Destroying inverter and/or communication module

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:

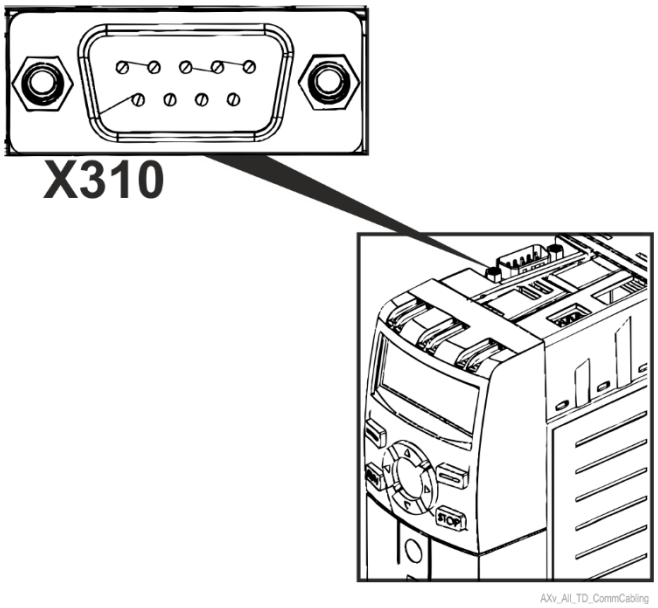
- Disconnect the frequency inverter from the mains voltage and protect it against being energized unintentionally.
- Disconnect the frequency inverter from the external 24 V if used and protect it against being energized unintentionally.



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

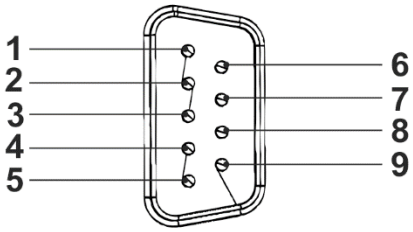
The CMA-232-01/CMA-485-01 module uses 9-pin D-Sub connectors.



X310	RS232/RS485, 9-pin D-Sub

The interface is electrically isolated from the inverter.

CMA-232-01 Technical characteristics: Bus Connector X310



CMA-232-01 9-pin D-Sub socket (female): Pin assignment

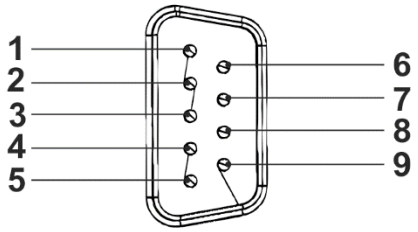
Pin	Name	Description
1	-	n. c. (not connected)
2	TxD	Transmit data (output)
3	RxD	Receive data (input)
4	-	n. c.
5	0 V	GND/earth
6	-	n. c.
7	-	n. c.
8	-	n. c.
9	-	n. c.

The RS232 interface is connected via the 9-pin D-Sub socket **X310**. The assignment complies with the standard, thus a RS232 connection cable (1:1) is required for connection only.

- If no pre-assembled connection cable is used, a twisted and shielded cable is to be used.
- 1:1 assignment of the pin contacts
- The shield must be a harness shield (not a foil shield)

- The shield is to be connected to PE properly on both sides.

CMA-485-01 Technical characteristics: Bus Connector X310



CMA-485-01 9-pin D-Sub socket (female): Pin assignment

Pin	Name	Description
1	Data Line B	RS-485 B-signal
2	Data Line B	RS-485 B-signal
3	0 V	GND/earth
4	-	Not connected
5	-	Not connected
6	0 V	GND/earth
7	Data Line A	RS-485 A-signal
8	Data Line A	RS-485 A-signal
9	-	Not connected

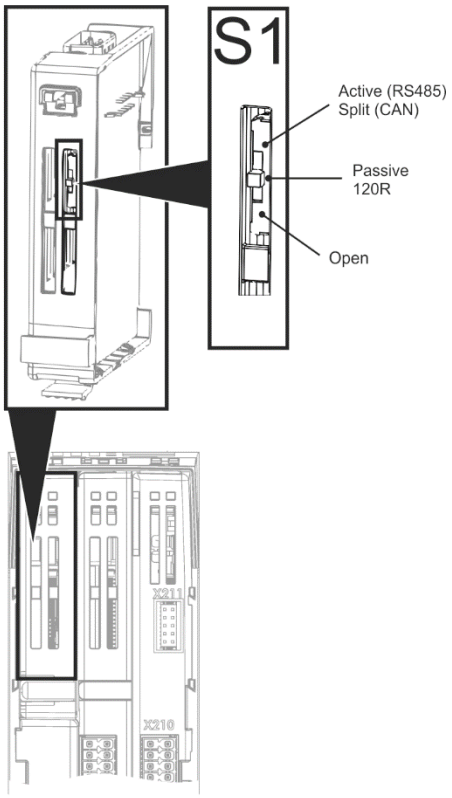
The RS485 interface is connected via the 9-pin D-Sub socket **X310.**

- For the bus cable RS485, the twisted and shielded line is to be used.
- The shield must be a harness shield (**not a foil shield**).
- The shield is to be connected to PE properly on both sides.
- The pin assignment of the RS485 cable is different from that of the RS232 cable; if you use the wrong cable, no communication is possible.
- The cable length is restricted by the BAUD rate:

BAUD rate	Max. cable length
9600 Baud	1200 m
19200 Baud	1200 m
57600 Baud	600 m
115200 Baud	300 m
230400 Baud	100 m

4.1.2 Bus termination (CMA-485-01 only)

The differential bus signals of the CMA-485-01 require termination for signal integrity and a stable communication. The termination of the CMA-485-01 must be configured depending on the intended position in the bus system. The termination can be passive or active and can be determined via DIP switch S1.



Use the switch "S1" as depicted above for bus termination as needed.

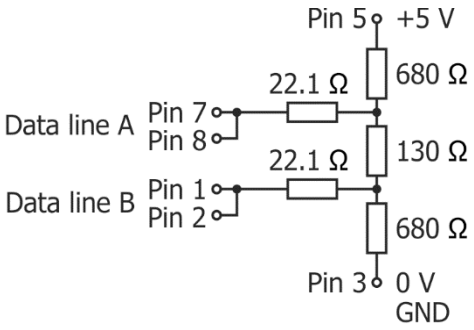
Active:	Active termination
Passive:	Termination resistor
Open:	Termination Off (factory setting)

The bus termination is required at the physically first and last client. It can be activated by the DIP Switch S1 of the CMA-485-01.

By default, the bus termination is set to **OFF**.

It is important to realize the correct termination. If not, no communication is possible by the CMA-485-01 interface.

As an alternative the active bus termination is possible via corresponding circuit:

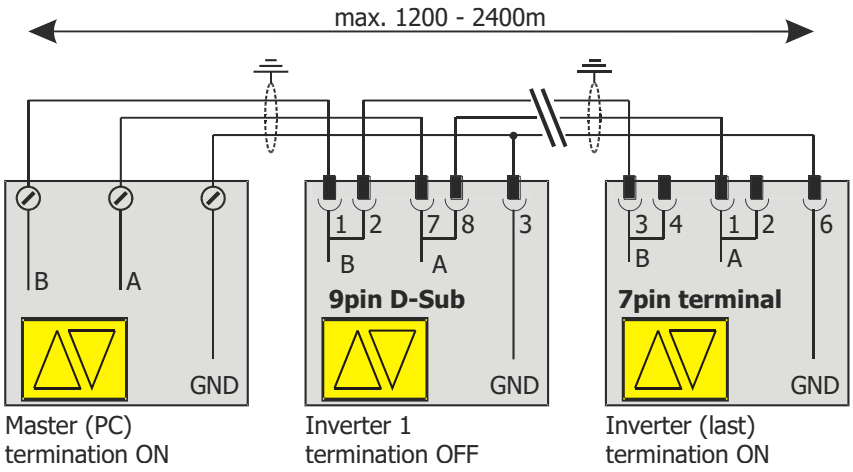


The active termination is only allowed once each branch. The bus termination via an external circuit and via DIP switch at the same time is not allowed.

Take care for the ground wiring. This will protect the communication bus against a high noise level.

For easy wiring the signal terminals A and B have parallel contacts.

Example of wiring with different CMA-485-01 modules:



4.1.3 Status LEDs

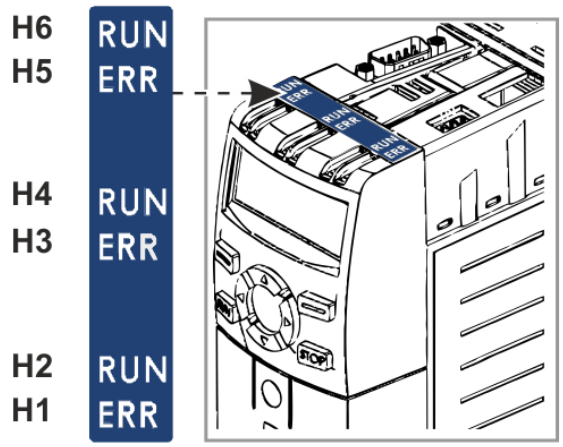
NOTICE

Residual risk

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

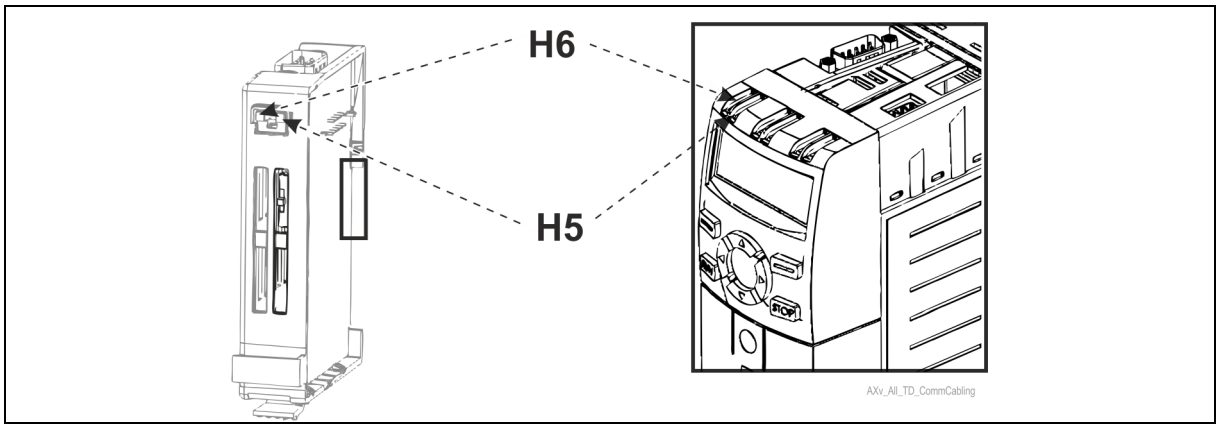
- Before carrying out any work with the device, where contact with energized parts might be possible, always check if the device is deenergized, irrespective of the status of any indicating elements.

- 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.



H5 Network status LED
H6 Module LED

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

For all Modbus settings use the following object:

Index: 0x3950
Name: Modbus Settings

The following settings of the communication module can be edited:

Object			Settings	
Index	**Sub index**	**Description**	**Available settings**	**Default**
0x3950	**1**	Modbus Baud rate	9600–230440 Baud	57600
0x3950	**2**	Serial Config	Databits / Parity / Stopbit	8-N-1
0x3950	**3**	Modbus Operating mode	RTU / ASCII / TCP	Deactivated
0x3950	**4**	Modbus address	1–255	1
0x3950	**5**	Active axis (for multi-axis device)	1/2	1

5.1 Setting the Modbus Operating Mode

Modbus is not activated by default and must be activated at the first start. Use the following object for this purpose:

Index	Sub index	Name	Object code	Data type
0x3950	3	Modbus operating mode	Record	UInt32

These values are possible:

Object 0x3950/3	
0	Deactivated (factory setting)
1	RTU
2	ASCII
5	TCP

Please note that only Modbus RTU and ASCII are realized with the CMA-232-01/CMA-485-01 module.

Modbus TCP is available via any Ethernet capable module including Profinet and EtherCAT. The only exception is the Basic I/O EtherCAT module. The Ethernet channel will be implemented at a later stage. Therefore, the CMA-232-01/ CMA-485-01 module can currently not be used in parallel to Basic I/O EtherCAT.

5.1.1 Setting the Baud rate

The baud rate can be configured using the following sub index. Changes can be made at any time and are effective immediately and without a restart of the frequency inverter.

Index	Sub index	Name	Object code	Data type
0x3950	1	Modbus baud rate	Record	UInt32

The following values are possible:

Object 0x3950/1	
9600	9600 Baud
19200	19200 Baud
38400	38400 Baud
57600	57600 Baud (default)
115200	115200 Baud
230400	230400 Baud

All bus clients must be set to the same baud rate.

Please note that the cable length is restricted by the baud rate,
☞ 4.1 “Installation”.

5.1.2 Setting Databits / Parity / Stopbit

The number of data bits, the parity and the number of stop bits can be configured with the help of the following sub index. Changes can be made at any time and are effective immediately and without a restart of the frequency inverter.

Index	Sub index	Name	Object code	Data type
0x3950	2	Serial Config	Record	UInt32

The following values are possible:

Object 0x3950/2	
0x00000701	7-N-1 (ASCII only)
0x00000702	7-N-2 (ASCII only)
0x00000711	7-E-1 (ASCII only)
0x00000712	7-E-2 (ASCII only)
0x00000721	7-O-1 (ASCII only)
0x00000722	7-O-2 (ASCII only)
0x00000801	8-N-1 (default)
0x00000802	8-N-2
0x00000811	8-E-1
0x00000812	8-E-2
0x00000821	8-O-1
0x00000822	8-O-2

NOTICE

Changes are effective immediately and without a restart of the frequency inverter.

5.1.3 Setting the Modbus Address

The Modbus address for Modbus RTU and ASCII can be set via the following object. Changes can be made at any time and are effective immediately and without a restart of the frequency inverter.

Index	Sub index	Name	Object code	Data type
0x3950	4	Modbus address	Record	UInt32

Object		Setting	
No.	**Description**	**Min.**	**Max.**
0x3950/4	Modbus address	1	255

An address must be allocated for each participant.

Double assignments are not permitted when allocating bus addresses.

☞ 7 "Object access"

5.1.4 Setting the Active Axis

The active axis can be set via this object when using multi-axis inverters.

Index	Sub index	Name	Object code	Data type
0x3950	5	Active Axis	Record	UInt8

The following values are possible:

Object 0x3950/5	
1	Axis 1 (default)
2	Axis 2

6 Protocol

The MODBUS serial communication protocol is a Master/Slave-Protocol. With the bus only one master is connected (at a time). One or several slave-nodes are connected with each other on the same bus. A MODBUS communication is always initiated by the master. The slave nodes do not communicate with each other. The master only initiates one MODBUS communication at a time.

Up to 255 frequency inverters can be operated on MODBUS. These are assigned addresses in the range 1 – 255. With address 0, all clients connected to the bus can be addressed simultaneously.

6.1 Message Structure

A MODBUS message is made up of the following fields:

Address	Function Code	Data	CRC (or LRC)

The **Address field** contains the slave address in the Modbus message.

Valid slave node addresses are in the range of 0 – 255 (decimal). The individual slave devices are assigned addresses in the range of 1 – 255. A master addresses a slave by placing the slave address in the address field of the message. When the slave returns its response, it places its own address in the response address field to let the master know which slave is responding. ☞ 7.

The **Function Code** indicates to the inverter what kind of action to perform. The function code can be followed by a data field that contains request objects (or, in the case of the inverters response, the response objects). For supported function codes, ☞ 7.2.

If no error occurs related to a correctly received Modbus request, the data field contains the data requested. If an error occurs, the field contains an Exception Code to indicate to the master that the request was unsuccessful. , ☞ 7.2.4 "Exception Responses".

If a request is not received correctly (communication error, checksum error) then no response is sent. The inverter waits for the next request.

The **Error Checking Field** is the result of a "Redundancy Checking" calculation that is performed on the message contents. Two kinds of calculation methods are used depending on the transmission mode that is being used (RTU or ASCII). ☞ 8 “Modbus Operating Modes”.

7 Object access

Modbus definitions for reading/writine data in a device do not exactly fit object access of inverters. Therefore it is necessary to map the register to the object number.

7.1 Address field

In the communication module, Modbus only defines registers. These registers consist of 16-bit values that can be recalled or written individually or in a block. All objects from the object directory of the Axia inverter, which are to be read or written by Modbus, are mapped into this address field. For this purpose, there is a static mapping (fixed assignment between object and register) as well as a dynamic mapping, where objects can be freely mapped into a certain area.

7.1.1 Static mapping

For static mapping, each object (index and sub index) is mapped to exactly one Modbus register. Reading or writing is possible only to one of these registers at a time. In this process, the data width is written over the number of registers, e.g. 4 bytes are written over 2 registers (for a Float data type).

The data types are processed as follows:

UInt8, Int8, Boolean:	1 register (only the low byte is relevant, high byte must be written "0" and is read as "0".
UInt16, Int16:	1 register
UInt32, Int32, Float:	2 registers
UInt64, Int64, Double:	4 registers

Example:

0x3951/1 Inside temperature

0x3951/2 PCB temperature

These two objects are each "float" data types and would therefore occupy a total of four registers. Thus, these objects would have to be mapped to four registers.

Register no. (example)[1)]	Content
100	Lower 16 bits of inside temperature
101	Upper 16 bits of inside temperature
102	Lower 16 bits of PCB temperature
103	Upper 16 bits of PCB temperature

1) Register numbers are randomly chosen to illustrate the principle.

This allows to recall both objects in a block. But it would also allow to recall e.g. only the lower 16 bits of a "float" individually. As it is not practical to recall half objects, all relevant objects must lie additionally in a coherent range.

For this reason, a different mapping is used:

Register no. (example)[1)]	Content
100	Inside temperature
101	PCB temperature

1) Register numbers are randomly chosen to illustrate the principle.

Please note that always the exact number of registers is read during a recall. It corresponds to the size of the object – in this case exactly two per access. A different number of accesses is not permitted.

7.1.1.1 Address field mapping

The address field is divided into Modbus "Holding Register" and "Input Register". This results in a total address field of 17 bits (16 bit holding and 16-bit input register).

The address field is sorted in groups as follows:

Axia objects	Holding Register	Input Register
0x1001 – 0x1FFF	n. a.	n. a.
0x2001 – 0x27FF	0x**S**001 – 0x**S**7FF	n. a.
0x3800 – 0x3FFF	0x**S**800 – 0x**S**EFF	n. a.
0x4000 – 0x47FF	n. a.	0x**S**000 – 0x**S**7FF
0x5800 – 0x5FFF	n. a.	0x**S**800 – 0x**S**FFF
0x6000 – 0x67FF	n. a.	n. a.
0xF000 – 0xF7FF	n. a.	n. a.

n. a. = not applicable

Here, **S** is used as sub index. This means that 4 bits (up to 16 sub indexes) are available per object. Thus, all data-set-dependent objects are covered but higher sub indexes can not be used in static mapping. There are only a few records that contain many sub indexes which are not applicable. These objects must either be preconfigured in the dynamic mapping or defined once with the GUI via the service interface.

The following object areas are excluded from static mapping:

- Communication objects in the range of 0x1XXX
- DS402 objects in the range of 0x6XXX (not available)
- Objects in the range 0x3F00 – 0x3FFF. (This area is used for dynamic mapping.)

When using multi-axis inverters, objects of the second axis can be accessed by setting the object *Active Axis* **0x3950/5** beforehand.

Index	Sub index	Name	Object code	Data type
0x3950	5	Active Axis	Record	UInt8

☞ 5.1.4 "Setting the Active Axis".

7.1.2 Dynamic mapping

In contrast to the static mapping, the dynamic mapping allows standard block access (both reading and writing). A fixed address range of the Modbus address field can be freely allocated with objects via parameterization. In the configuration, a new object is defined in the object directory.

Index	Sub index	Name	Object code	Data type	Info
0x3951	1 – 128	Modbus Object Mapping	Array	UInt32	FFIIIISS

All entries in the array are defined as follows:

FF: Flags (Bit 0: permanent write accesses Yes/No. Other bits are reserved → Set to zero)

IIII: Index of the object to be mapped.

SS: Sub index of the object to be mapped.

Up to 128 objects can be mapped into the dedicated Modbus block transfer area (Holding Register 0xFF00 – 0xFFFF). Depending on the data type, the objects are mapped as follows:

UInt8, Int8, Boolean:	1 register (only the low byte is relevant, high byte must be written "0" and is read as "0").
UInt16, Int16:	1 register
UInt32, Int32, Float:	2 registers
UInt64, Int64, Double:	4 registers

If only Float data types are used for mapping, the entire address range can be used by the 128 objects.

If only UInt16 objects are used for mapping, only half of the address field is used.

When using Int64, a maximum of 64 objects can be mapped.

Example:

0x3951/1 inside temperature

0x3951/2 PCB temperature

Register	Content
0xFF00	Lower 16 bits of inside temperature
0xFF00	Upper 16 bits of inside temperature
0xFF00	Lower 16 bits of PCB temperature
0xFF00	Upper 16 bits of PCB temperature
…	
0xFFFF	

From this register area any desired number of subsets can be recalled and start register and length are freely selectable. Object boundaries should be considered when writing: Start and end point must not lie amidst an object.

The maximum number of registers result from the maximum frame length of 256 bytes.

Please note, that there may be read-only objects in the mapped area. If the block write is used the read-only objects **must** be written with 0xFFFF in each corresponding register.

7.2 Supported Function Codes

The access to objects via the Modbus protocol is possible by mapping the Modbus address range to the index/sub index addressing of the Axia object register. For this, only standard function codes are implemented. There is no user-specific extension.

Modbus definitions for reading/writing data in a device do not fit directly to object access of inverters (independent of inverter manufacturer). Modbus is defined for reading/writing bits and registers in a different way. Furthermore, data access is limited to 16-bit wide data.

To fulfill the Modbus requirements the data access to objects in the devices (inverters) uses the following standard function codes:

16 bits values:

- Read Holding Register: Function Code 3, Read one 16-bit wide data
- Read Input Register: Function Code 4, Read one 16-bit wide data
- Preset Multiple Register: Function Code 10, Write one 16-bit wide data

32 bits values:

For data access to 32-bit wide data two new inverter specific function codes are defined:

- Read Holding Register: Function Code 3, Read two 16 bits (=32 bit) wide data
- Read Input Register: Function Code 4, Read two 16 bits (=32 bit) wide data
- Preset Multiple Register: Function Code 16, Write two 16 bits (=32 bit) wide data

The Modbus specification does not specify the handling of 32-bit values. The implemented handlings and function codes to access 32-bit values are however widely spread and commonly used. These functions allow data access to 32 bit "long" variables/objects in the inverter.

In all data fields with more than one byte, the highest order byte is transmitted first.

7.2.1 Read Holding Register (8/16 bit or 32-bit objects)

With this command it is possible to read one or more contiguous holding register objects. This command is used for both static and dynamic mapping. The function code 0x03 is used to read the value of 16 bit or 32-bit objects in the inverter.

Request 8/16 Bit:

Slave address	Function code	Register		No. of Registers		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
	0x03			00	01		

Request 32 Bit:

Slave address	Function code	Register		No. of Registers		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
	0x03			00	02		

Response 8/16 Bit:

Slave address	Function code	No. of Bytes	Register value		CRC	
			MSB	LSB	MSB	LSB
	0x03	02				

Response 32 Bit:

Slave address	Function code	No. of Bytes	Register value				CRC	
			MSB	...	...	LSB	MSB	LSB
	0x03	04						

Request 8/16 Bit object read:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x03
Register	2 Bytes	0x0000 – 0xFFFF
No. of Registers 8 Bit	1 Byte	0x0001
No. of Registers 16 Bit	2 Bytes	0x0001
CRC or LRC & Endframe		

Response 8/16 Bit object read:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x03
No. of Bytes	1 Byte	0x02
Register Value	2 Bytes	0 – 0xFFFF
CRC or LRC & Endframe		

Request 32 Bit object read:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x03
Register	2 Bytes	0x0000 – 0xFFFF
No. of Registers	2 Bytes	0x0002
CRC or LRC & Endframe		

Response 32 Bit object read:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x03
No. of Bytes	2 Bytes	0x04
Register Value	4 Bytes	0 – 0xFFFFFFFF
CRC or LRC & Endframe		

Exception Response:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Error Code	1 Byte	0x83
Exception Code	1 Byte	2, 3 or 4
CRC or LRC & Endframe		

Byte Count

This field is set to:

- 2 for 8/16-bit object
- 4 for 32-bit object

Register Value

This field contains the object value.

Exception Code

The following exception codes can occur:

Code	Modbus Name	Cases when generated by the inverter
2	ILLEGAL DATA ADDRESS	No. of Registers field not equal to 1. Object unknown
3	ILLEGAL DATA VALUE	No. of bytes in the data field too small or too large
4	SLAVE DEVICE FAILURE	Error on reading the object

Exception Codes are described in detail in chapter 7.2.5 "Exception Codes".

7.2.2 Read Input Register (16 bit or 32-bit objects)

With this command, it is possible to read single input register objects. This command can be used for static mapping only. Function code 0x04 can be used to read the value of 16 Bit objects in the inverter.

Request 16 Bit:

Slave address	Function code	Register		No. of Reg.		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
	0x04			00	01		

Request 32 Bit:

Slave address	Function code	Register		No. of Reg.		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
	0x04			00	02		

Response 16 Bit:

Slave address	Function code	No. of Bytes	Register value		CRC	
			MSB	LSB	MSB	LSB
	0x04	02				

Response 32 Bit:

Slave address	Function code	No. of Bytes	Register value				CRC	
			MSB	...	...	LSB	MSB	LSB
	0x04	04						

Request 16 Bit object write:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x04
Register	2 Bytes	0x0000 – 0xFFFF
No. of Registers	1 Byte	0x0001
CRC or LRC & Endframe		

Response 16 Bit object:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x04
No. of Bytes	1 Byte	0x02
Register Value	2 Bytes	0 – 0xFFFF
CRC or LRC & Endframe		

Request 32 Bit object read:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x03
Register	2 Bytes	0x0000 – 0xFFFF
No. of Registers	2 Bytes	0x0002
CRC or LRC & Endframe		

Response 32 Bit object read:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x03
No. of Bytes	1 Byte	0x04
Register Value	4 Bytes	0 – 0xFFFFFFFF
CRC or LRC & Endframe		

Exception Response:

Start Frame (RTU or ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Error Code	1 Byte	0x83
Exception Code	1 Byte	2, 3 or 4
CRC or LRC & Endframe		

Exception Response:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Error Code	1 Byte	0x83
Exception Code	1 Byte	1, 2, 3 or 4
CRC or LRC & Endframe		

Register Value

This field contains the object value.

Exception Code

The following exception codes can occur:

Code	Modbus Name	Cases when generated by the inverter
1	ILLEGAL FUNCTION	Function code unknown Subfunction code unknown
2	ILLEGAL DATA ADDRESS	Object unknown
3	ILLEGAL DATA VALUE	No. of bytes in the data field too small or too large
4	SLAVE DEVICE FAILURE	Error on reading the object

Exception Codes are described in detail in chapter 7.2.5 "Exception Codes".

7.2.3 Write Multiple Registers

With this command, it is possible to write one or more consecutive holding registers. This command is used for both static and dynamic mapping.

In static mapping, it is used to read objects with more than 2 bytes.

Slave addr.	Function code	Register		No. of Reg.		No. of Bytes	Value(s)			CRC	
		MSB	LSB	MSB	LSB		MSB	…	LSB	MSB	LSB
	0x10										

Function code 0x10 can be used to write the value of 16-bit objects or 32-bit objects in the inverter.

Request 16 Bit object write:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x10
Register	2 Bytes	0x0000 – 0xFFFF
No. of Registers	2 Bytes	0x0001
No. of Bytes	1 Byte	0x02
Register Value	2 Bytes	0 – 0xFFFF
CRC or LRC & Endframe		

Response 16 Bit object write:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x10
No. Of Bytes	2 Bytes	0x0000 – 0xFFFF
Register value	2 Bytes	0x0001
CRC or LRC & Endframe		

Request 32 Bit object write:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x10
Register	2 Bytes	0x0000 – 0xFFFF
No. of Registers	2 Bytes	0x0002
No. of Bytes	1 Byte	0x04
Register Value (Object Value)	2 Bytes	0 – 0xFFFF FFFF
CRC or LRC & Endframe		

Response 32 Bit object write:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Function Code	1 Byte	0x10
No. of Bytes	2 Bytes	0x0000 – 0xFFFF
Register value	2 Bytes	0x0002
CRC or LRC & Endframe		

Exception Response:

Start Frame (RTU oder ASCII mode)		
Address	1 Byte	1 – 0xFF (=255)
Error Code	1 Byte	0x90
Exception Code	1 Byte	2, 3 or 4
CRC or LRC & Endframe		

Register Value

This field is used to store the 16-bit or 32-bit object value.

Exception Code

The following exception codes can occur:

Code	Modbus Name	Cases when generated by the inverter
2	ILLEGAL DATA ADDRESS	Object unknown
3	ILLEGAL DATA VALUE	No. of bytes in the data field too small or too large
4	SLAVE DEVICE FAILURE	Error on reading the object

Exception Codes are described in detail in chapter 7.2.5 "Exception Codes".

7.2.4 Exception Responses

When the master device sends a request to the inverter it expects a normal response. One of four possible events can occur from the master's query:

- If the inverter receives the request without a communication error and can handle the query normally, it returns a normal response.
- If the inverter does not receive the request due to a communication error, no response is returned. The master will eventually process a timeout condition for the request.
- If the inverter receives the request, but detects a communication error (parity, LRC, CRC, ...), no response is returned. The master will eventually process a timeout condition for the request.
- If the inverter receives the request without a communication error, but cannot handle it (for example, if the request is to read an unknown object), the inverter will return an exception response informing the client of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:

Function Code Field:
In a normal response, the inverter echoes the function code of the original request in the function code field of the response. All function codes have a most–significant bit (MSB) of 0 (their values are all below 0x80 hexadecimal). In an exception response, the inverter sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 0x80 hexadecimal higher than the value would be for a normal response. With the function code's MSB set, the master can recognize the exception response and can examine the data field for the exception code.

Data Field:
In a normal response, the inverter may return data or statistics in the data field (any information that was requested in the request). In an exception response, the inverter returns an exception code in the data field. This defines the server condition that caused the exception.

The Exception Codes generated by the inverter are listed below.

7.2.5 Exception Codes

The following exception codes are generated by the inverter:

Code	Modbus Name	Cases when generated by the Inverter
1	ILLEGAL FUNCTION	Function Code unknown Subfunction Code unknown (Diagnostics Function)
2	ILLEGAL DATA ADDRESS	No. of Registers field incorrect (must always be 0x01) Unknown object or object Data Type mismatch
3	ILLEGAL DATA VALUE	Error in data set of frame No. of bytes too small or too large Certain fields not set to specific values
4	SLAVE DEVICE FAILURE	Error on reading the object Read or Write object failed The reason for the error can be obtained by reading out object *Error Register* **0x1001**.

7.3 Time Monitoring Function

The Modbus protocol defines a pure Master/Slave operation. If a frequency inverter is addressed by the bus master, other frequency inverters will only be addressed after the protocol with the first frequency inverter has been completed or the timeout time has expired.

After a frequency inverter has sent a message, a waiting time of **2 ms** must be kept. This time is needed by the frequency inverter in order to switch off the 485 transmitter. The bus master may not send a new message until this time has elapsed.

7.4 Handling of Data sets/Cyclic Writing

Access to the object values is carried out on the basis of the object number and the required data set.

There are objects which only have one value as well as objects which have four values. The latter are used for the data set change-over of an object.

With **dynamic mapping**, write access is made as specified by the flags during mapping. Permanent cyclic write access must be avoided. With **static mapping**, all write operations take place permanently, i. e. in the EEPROM of the frequency inverter.

NOTICE

Component damage possible

Only a limited number of write cycles is permissible for the EEPROM (approx. 1 million cycles). When this number is exceeded, the EEPROM will be destroyed.

- If values are to be written cyclically with a high repetition rate, avoid entries into the EEPROM.
- Data which must be written cyclically can be entered in the RAM exclusively without a writing cycle on the EEPROM. In this case, the data is volatile, i.e. it is lost when the supply voltage is switched off (Mains Off). Data must be written into the RAM again after the restart (Mains On).

As a safety measure, the number of consecutive write cycles per minute is limited to 10. This safety measure works for up to 32 objects.

8 Modbus Operating Modes

Two different serial transmission modes are defined: the **RTU mode** and the **ASCII mode**. They define the bit contents of message fields transmitted serially on the line. They determine how information is packed into the message fields and how it is decoded.

The transmission mode (and serial port objects) must be the same for all devices on a MODBUS Serial Line.

The transmission mode for the Modbus-Communication can be selected via object Modbus operating mode **3950/3**. ☞ 5.1 "Setting the Modbus Operating Mode".

8.1 RTU Transmission

When devices communicate on a MODBUS serial line using the RTU (Remote Terminal Unit) mode, each 8-bit byte in a message contains two 4-bit hexadecimal characters.

The main advantage of this mode is that its greater character density allows better data throughput than ASCII mode for the same baud rate. Each message must be transmitted in a continuous stream of characters.

8.1.1 Character Format

The bit length depends on the settings of the object *Serial Config*, ☞ 5.1.2

The default setting is "8-N-1" which consists of 11 bits:

- 1 start bit
- 8 data bits, least significant bit sent first
- 1 parity bit
- 1 stop bit

If no parity is used then an extra stop bit is added.

Character format with parity checking:

Start	B1	B2	B3	B4	B5	B6	B7	B8	Parity	Stop

Character format without parity checking:

Start	B1	B2	B3	B4	B5	B6	B7	B8	Stop	Stop

8.1.2 Frame Description

Slave Address	Function Code	Data	CRC
1 Byte	1 Byte	0 to 252 Bytes	2 Bytes (CRC-Lo, CRC-Hi)

The maximum size of a MODBUS RTU frame is 256 bytes.

8.1.3 Modbus Message RTU Framing

A MODBUS message is placed by the transmitting device into a frame that has a known beginning and ending point. This allows devices that receive a new frame to begin at the start of the message, and to know when the message is completed. Partial messages must be detected and errors must be set as a result. In RTU mode, message frames are separated by a silent interval of at least 3.5-character times.

MODBUS Message					
Start	**Address**	**Function**	**Data**	**CRC**	**End**
>= 3,5 Char	8 Bits	8 Bits	N x 8 Bits	16 Bits	>= 3,5 Char

The entire message frame must be transmitted as a contiguous stream of characters.

If a silent interval of more than 1.5-character times occurs between two characters, the message frame is declared incomplete and is discarded by the inverter.

8.2 ASCII Transmission

When devices are setup to communicate on a MODBUS serial line using 7-bit ASCII (American Standard Code for Information Interchange) mode, each 8-bit character in a message is sent as two ASCII characters. This mode is used when the physical communication link or the capabilities of the device does not allow the conformance with RTU mode requirements regarding the management of timers.

This mode is less efficient than RTU since each byte needs two characters.

Example:
The byte 0x5B is encoded as two characters: 0x35 and 0x42 (0x35 ="5", and 0x42 ="B" in ASCII).

8.2.1 Character Format

The bit length depends on the settings of the object *Serial Config*, ☞ 5.1.2

The default setting is "8-N-1" which consists of 10 bits:

- 1 start bit
- 7 data bits, least significant bit sent first (value = 0x00 ... 0x7F)
- 1 parity bit
- 1 stop bit

If no parity is used then an extra stop bit is added.

Character format with parity checking:

Start	B1	B2	B3	B4	B5	B6	B7	Parity	Stop

Character format without parity checking:

Start	B1	B2	B3	B4	B5	B6	B7	Stop	Stop

8.2.2 Modbus Message ASCII Framing

A MODBUS message is placed by the transmitting device into a frame that has a known beginning and ending point. This allows devices that receive a new frame to begin at the start of the message, and to know when the message is completed. Partial messages must be detected and errors must be set as a result.

The address field of a message frame contains two characters.

In ASCII mode, a message is delimited by specific characters as Start-of-Frame and End-of-Frame. A message must start with a trigger "colon"- character (":" = ASCII 0x3A) and ends with a "carriage return/line feed" pair (ASCII 0x0D and 0x0A).

The allowable characters transmitted for all other fields are hexadecimal 0–9, A–F (ASCII coded). The devices monitor the bus continuously for the colon character. When this character is received, each device decodes the next character until it detects the End-of-Frame (EoF)-character.

Intervals of up to one second may elapse between characters within the message. Unless the user has configured a longer timeout, an interval greater than 1 second means an error has occurred.

A typical message frame is shown below:

SoF	Address	Function	Data	LRC	EoF
1 char :	2 chars	2 chars	0 up to 2* 252 chars	2 chars	2 chars CR, LF

8.2.3 ASCII-Table (0x00 – 0x7F)

Dec.	Hex.	Char.	Dec.	Hex.	Char.	Dec.	Hex.	Char.
0	00	NUL	43	2B	+	86	56	V
1	01		44	2C	,	87	57	W
2	02	STX	45	2D	-	88	58	X
3	03	ETX	46	2E	.	89	59	Y
4	04	EOT	47	2F	/	90	5A	Z
5	05	ENQ	48	30	0	91	5B	[
6	06	ACK	49	31	1	92	5C	\
7	07	BEL	50	32	2	93	5D	]
8	08	BS	51	33	3	94	5E	^
9	09	TAB	52	34	4	95	5F	_
10	0A	LF	53	35	5	96	60	`
11	0B	VT	54	36	6	97	61	a
12	0C	FF	55	37	7	98	62	b
13	0D	CR	56	38	8	99	63	c
14	0E		57	39	9	100	64	d
15	0F		58	3A	:	101	65	e
16	10		59	3B	;	102	66	f
17	11		60	3C	<	103	67	g
18	12		61	3D	=	104	68	h
19	13		62	3E	>	105	69	i
20	14		63	3F	?	106	6A	j
21	15	NAK	64	40	@	107	6B	k
22	16		65	41	A	108	6C	l
23	17		66	42	B	109	6D	m
24	18		67	43	C	110	6E	n
25	19		68	44	D	111	6F	o
26	1A		69	45	E	112	70	p
27	1B	ESC	70	46	F	113	71	q
28	1C		71	47	G	114	72	r
29	1D		72	48	H	115	73	s
20	1E		73	49	I	116	74	t
31	1F		74	4A	J	117	75	u
32	20	SPACE	75	4B	K	118	76	v
33	21	!	76	4C	L	119	77	w
34	22	„	77	4D	M	120	78	x
35	23	#	78	4E	N	121	79	y
36	24	$	79	4F	O	122	7A	z
37	25	%	80	50	P	123	7B	{
38	26	&	81	51	Q	124	7C	|
39	27	'	82	52	R	125	7D	}
40	28	(	83	53	S	126	7E	~
41	29	)	84	54	T	127	7F	DEL
42	2A	*	85	55	U			

Values used often are highlighted in grey.

9 Modbus RTU Message Examples

This chapter describes some examples for Modbus RTU.

9.1 Static Mapping

9.1.1 Read 32-Bit Readonly Object

Reading object External 24 V Voltage from the frequency inverter:

Name:	*External 24 V Voltage*
Index:	**0x5801**
Subindex:	**0x02**
Data type:	Float32

Static mapping according to the table:

0x5801, 02 → Use Modbus Function code 0x04: 0x2801 (10241)

Request:

MB address	Function code	Start Register		No. of Registers		CRC	
01	04	28	01	00	02	29	AB

Response:

MB address	Function code	No. of Bytes	Value				CRC	
01	04	04	41	BE	1B	94	84	C3

The hexadecimal value is 0x41BE1B94 which corresponds to 23.7635 V.

9.1.2 Read 32-Bit Read/Write Object

Reading object Rated Current from the frequency inverter:

Name:	*Rated Current*
Index:	**0x2003**
Subindex:	**0x01**
Data type:	Float32

Static mapping according to the table:

0x2003, 01 → Use Modbus Function code 0x03: 0x1003 (4099)

Request:

MB address	Function code	Start Register		No. of Registers		CRC	
01	03	10	03	00	02	30	CB

Response:

MB address	Function code	No. of Bytes	Value				CRC	
01	03	04	40	86	66	66	A5	90

The hexadecimal value is 0x40866666 which corresponds to 4.2 A.

9.1.3 Write 32-Bit Read/Write Object

Writing object Rated Current 0x2003 to the frequency inverter:

Name:	*Rated Current*
Index:	**0x2003**
Subindex:	**0x01**
Data type:	Float32

The rated current is to be set to 4.1 which corresponds to 0x4083333333 (float).

Static mapping according to the table:

0x2003, 01 → Use Modbus Function code 0x10: 0x1003 (4099)

Request (Write to 4.1 A → 0x40833333)

MB address	Function code	Start Register		No. of Registers		No. of Bytes	Value(s)				CRC	
01	10	10	03	00	02	04	40	83	33	33	30	CB

Response:

MB address	Function code	Start Register		No. of Registers		CRC	
01	10	10	03	00	02	B5	08

The response contains the numbers of registers written.

9.1.4 Read 16-Bit Read/Write Object

Reading object Sysbus Node ID from the frequency inverter:

Name:	*Sysbus Node ID*
Index:	**0x3910**
Subindex:	**0x01**
Data type:	UInt8

Static mapping according to the table:

0x3910, 01 → Use Modbus Function code 0x03: 0x1910 (6416)

Request:

MB address	Function code	Start Register		No. of Registers		CRC	
01	03	19	10	00	01	82	93

Response:

MB address	Function code	No. of Bytes	Value		CRC	
01	03	02	00	02	A5	90

Value 0x0002 → 2

9.1.5 Write 16-Bit Read/Write Object

Writing object Sysbus Node ID to the frequency inverter:

Name: *Sysbus Node ID*

Index: **0x3910**

Subindex: **0x01**

Data type: UInt8

Static mapping according to the table:

0x3910, 01 → Use Modbus Function code 0x10: 0x1910 (6416)

Request (Write to 1 → 0x0001)

MB address	Function code	Start Register		No. of Registers		No. of Bytes	Value(s)		CRC	
01	10	19	10	00	01	02	00	01	ED	C1

Response:

MB address	Function code	Start Register		No. of Registers		CRC	
01	10	19	10	00	01	07	50

9.2 Dynamic Mapping

9.2.1 Configuration

First, you have to setup the mapping with object **0x3951/d01** as follows:

Map object 1 (*Ext. 24 V Voltage*): 5801/02 (4 Bytes, 2 Registers)	→	Write 3951/01 to 0x00025801
Map object 2 (*Rated Current*): 2003/01 (4 Bytes, 2 Registers)	→	Write 3951/01 to 0x00012003
Map object 3 (*Sysbus Node ID*): 3910/01 (2 Bytes, 1 Register)	→	Write 3951/01 to 0x00013910

9.2.2 Read Complete Mapping (5 Bytes)

Dynamic mapping according to the table:

Use Modbus Function code 0x03: 0xFF00 (65280)

Request:

MB address	Function code	Start Register		No. of Registers		CRC	
01	03	FF	00	00	05	B5	DD

Response:

MB address	Function code	No. of Bytes	Value										CRC	
01	03	0A	41	BE	3A	98	40	86	66	66	00	05	84	C3

Values:	0x41BE3A98	→	23.7786 V
	0x40866666	→	4.2 A
	0x0005	→	5

9.2.3 Write Complete Mapping (5 Bytes)

Dynamic mapping according to the table:

Use Modbus Function code 0x10: 0xFF00 (65280)

Request (Write to Readonly → 0xFFFFFFFF, 4.1 A → 0x4083333333, 5 → 0x0005):

MA address	Function code	Start Register		No. of Registers		Value										CRC	
01	10	FF	00	00	05	FF	FF	FF	FF	40	83	33	33	00	05	FA	EC

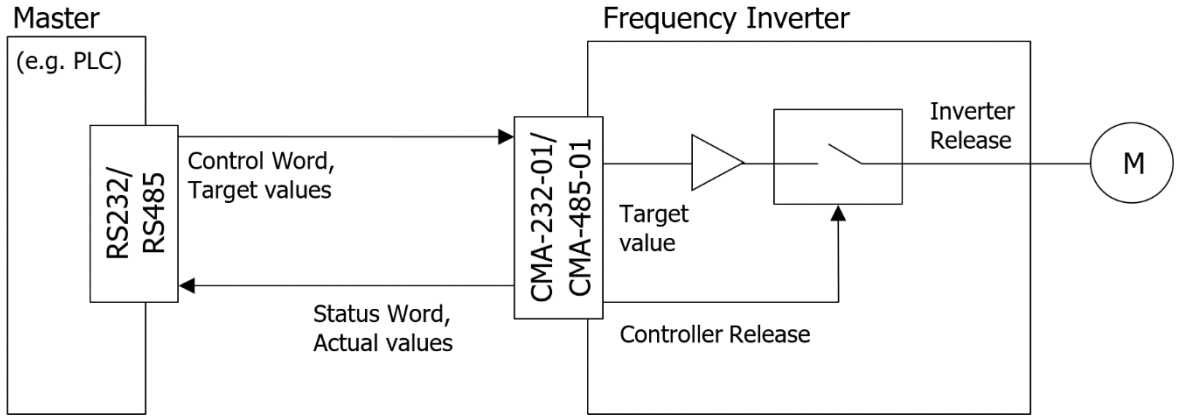
Response:

MB address	Function code	Start Register		No. of Registers		CRC	
01	10	FF	00	00	05	30	1E

10 Control of Frequency Inverter

The PLC can control the frequency inverter completely via the serial interface. Generally, the control over Modbus is possible using all available objects. ☞🕮 the Operating Instructions of the frequency inverter for more details.

Please note that the DS402 Drive Profile objects (**0x6000** – **0x7FFF**) are only accessible with dynamic mapping.



The Master (PLC) sends its control commands to the frequency inverter via Modbus as an output and gets back the input of the status:

Object			Setting			
Index	**Sub index**	**Designation**	**Type**	**Min.**	**Max.**	**Default Value**
0x6040	0	Control Word	UInt16	0	65535	0
0x6041	0	Status Word	UInt16	0	0	0

With the *Control Word* **0x6040**, control commands are sent to the frequency inverter. Via the *Status Word* **6041**, the status of the frequency inverter is read out.

Control Word **0x6040** is stored in the RAM of the frequency inverter. This is generally addressed via data set 0.

The frequency inverter can be controlled with various control modes. The control mode can be selected with object *Control Mode* **0x2200/d01**. For more information on setting the control mode ☞🕮 the Operating Instructions of the frequency inverter.

If the *Control Mode* **0x2200/d01** is set to mode `3 -State machine` the frequency inverter can be controlled with various operation modes. These operation modes can be selected with object **0x6060** *Mode of operation*. For more information on setting the mode of operation ☞🕮 the Operating Instructions of the frequency inverter.

0x6040 Control Word

Object *Control Word* **0x6040** is relevant to the frequency inverter if object *Control Mode* **0x2200/d01** is set to "`0x00000003 - State machine`". In this mode, the frequency inverter is controlled via the control word of the State machine.

For more information on the object *Control Word* ☞🕮 the Operating Instructions of the frequency inverter.

0x6041 Status Word

Object *Status Word* **0x6041** shows the current state of the frequency inverter.

For more information on the object *Status Word* ☞🕮 the Operating Instructions of the frequency inverter.

10.1 Special behavior in Modbus

10.1.1 Control via State machine

In control Mode 3 "State machine", (object *Control Mode* **0x2200/255** = `3: State-Machine`), the following operation modes cannot be selected with object **0x6060** *Mode of operation*:

- 0x00000008 (Cyclic Synchronous position)
- 0x00000009 (Cyclic Synchronous velocity)
- 0x0000000A (Cyclic Synchronous torque)

10.1.2 Control via IOs

In control mode 1 "IOs" (object *Control Mode* **0x2200/255** = `1: IOs`), the frequency inverter is controlled via the digital inputs or via the multi-functional inputs that have been set to digital inputs.

10.1.3 Control via PLC

In control mode 4 "PLC" (object *Control Mode* **0x2200/255** = `4: PLC`), the frequency inverter is controlled via the individual bits of the virtual digital inputs in the control word.

If the frequency inverter is controlled via the digital inputs, then in this operation mode control via the *Control Word* **0x6040** does not apply.

If the operation mode "PLC" is used, the Controller Release "STOA+STOB" must be switched on and bit 0 of the control word must be set, in order to start the drive.

With the use of Remote Contacts the signal sources (digital inputs or multifunctional inputs set as digital inputs) are taken virtually from the *Control Word* **0x6040**. Signals at the hardware terminals are not evaluated in the standard operation modes.

Operation modes which are marked with the extension (Hardware) are available in order to evaluate signals at the hardware terminals.

Exception: The release must always be made via hardware-inputs IN1D (Terminal X210).

A Controller Release by software alone is not possible.

The frequency inverter supports an external 24 V voltage supply for the control electronics of the frequency inverter. Communication between the controlling device (PLC) and the frequency inverter is still possible even when the mains supply has been switched off.

Bit 4 "Voltage enabled" in the status word indicates the current status of the mains supply.

Bit 4 "Voltage enabled" = 0 signals "no mains supply" and that starting the drive is not possible.

Bit 4 "Voltage enabled" = 1 signals "mains supply switched on" and drive ready for starting.

11 Objects

The available objects are marked with index and sub index 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)	$0…2^{32}$-1 0…0xFFFF FFFF	(0…4294967295)
Unsigned16	16 Bit value: (UINT)	$0…2^{16}$-1 0…0x FFFF	(0…65535)
Unsigned8	8 Bit value: (USINT)	$0…2^{8}$-1 0…0xFF	(0…255)
Integer32	Signed 32 Bit value: (DINT)	$-2^{31}…2^{31}$-1 0x8000 0000…0x7FFF FFFF	(-2147483648 … 2147483647)
Integer16	Signed 16 Bit value: (INT)	$2^{15}…2^{15}$-1 0x8000…0x7FFF	(-32768…32767)
Integer8	Signed 8 Bit value: (SINT)	$2^{7}…2^{7}$-1 0x80…0x7F	(-128…127)
Float32	32 Bit value:	$2^{-149}…2^{127}$	(0…16777216)

"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 are sorted in groups as follows:

- DS301 Communication Objects: **0x1000** – **0x1FFF** (not available here)
- Bonfiglioli-specific objects: **0x2001** – **0x5FFF** with

Axis-dependent object ranges:

- **0x2001** – **0x27FF**
- **0x4000** – **0x47FF**

The Bonfiglioli-specific objects can be subdivided in axis-dependent objects versus axis-independent objects. There is an offset of 0x800 per axis in the axis-dependent range.

Example:

0x2001 *Motor Type* on Axis 1 and **0x2321** *Motor Type* on Axis 2. The Bonfiglioli-specific objects in the range

- **0x3000** – **0x37FF**
- **0x5800** - **0x5FFF**

are not axis-dependent.

- DS402 Drive Profile objects: **0x6000** – **0x7FFF** (accessible only with dynamic mapping)

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 data set Axis1
0x4800	0x4FFF	Actual Values: Readings for Axis 2 Example: 0x4801 for active data set Axis2
0x5800	0x5FFF	Actual Values: axis independent readings Example: 0x5801 for DC-link Voltage

11.1 Available objects

Object			Value setting		Chapter
Index	**Sub index**	**Name**	**Min.**	**Max.**	
0x3950	1	Modbus operating mode	0	5	5.1
0x3950	2	Modbus Baud rate	0	5	5.1.1
0x3950	3	Serial Config	0	11	5.1.2
0x3950	4	Modbus address	0	255	5.1.3
0x3950	5	Active Axis	0	1	5.1.4
0x3951	1 – 128	Modbus Object Mapping			7.1.2

11.2 Error Messages

The various control methods and the hardware of the frequency inverter include functions which continuously monitor the application. The following error messages are activated by the CMA-232-01/CMA-485-01 communication module.

Error messages and troubleshooting		
F00	00	No error has occurred
	02	Frequency inverter was overloaded (60 sec), check load behavior.
	03	Short-term overload (1 sec), check motor and application objects.
F02	00	Case temperature outside the temperature limits, check cooling and fan.
F03	00	Inside temperature outside the temperature limits, check cooling and fan.
F04	00	Motor temperature too high or sensor defective.
F05	00	Motor phase current above current limits, check load situation and ramps.
	03	Short circuit or earth fault, check motor and wiring.
	05	Asymmetric motor current, check current and wiring.
	07	Message from phase monitoring, check motor and wiring.
F07	00	DC link voltage outside the voltage range, check deceleration ramps and connected brake resistor.
	01	DC link voltage too low, check mains voltage.
	02	Power failure, check mains voltage and circuit.
	06	Motor chopper trigger voltage too low, check mains voltage.
F08	01	Electronics voltage 24 V too low, check control terminal.
	04	Electronics voltage too high, check wiring of control terminals.
F11	00	Output frequency too high, check control signals and settings.
	01	Max. frequency reached by control, check deceleration ramps and connected brake resistor.
	30	Speed sensor signal defective, check connections S4IND and S5IND.
	31	One track of the speed sensor signal is missing, check connections.

Additional fault messages are described in the Operating instructions of the frequency inverter.

Index

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
São Bernardo do Campo - São Paulo
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, 4th 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

PRODUCTION
ASSEMBLY
SALES
SERVICE

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 Riduttori S.p.A. **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, n°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 - Izmir
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

Bonfiglioli

Abbiamo un'inflessibile dedizione per l'eccellenza, l'innovazione e la sostenibilità. Il nostro Team crea, distribuisce e supporta soluzioni di Trasmissioni e Controllo di Potenza per mantenere il mondo in movimento

We have a relentless commitment to excellence, innovation & sustainability. Our team creates, distributes and services world-class power transmission & drive solutions to keep the world in motion.

Wir verpflichten uns kompromisslos zu Qualität, Innovation und Nachhaltigkeit. Unser Team entwickelt, vertreibt und wartet erstklassige Energieübertragungs- und Antriebslösungen, um die Welt in Bewegung zu halten

Notre engagement envers l'excellence, l'innovation et le développement durable guide notre quotidien. Notre Équipe crée, distribue et entretient des solutions de transmission de puissance et de contrôle du mouvement contribuant ainsi à maintenir le monde en mouvement.

Tenemos un firme compromiso con la excelencia, la innovación y la sostenibilidad. Nuestro equipo crea, distribuye y da soporte en soluciones de transmisión y control de potencia para que el mundo siga en movimiento.

COD. VEC 2en3A R1

HEADQUARTERS
Bonfiglioli S.p.A
Registered Office: Via Bazzane, 33
40012 Calderara di Reno BO
Head office: Via Isonzo, 65/67/69
40033 Casalecchio di Reno BO
ITALY

tel: +39 051647 3111
www.bonfiglioli.com