

Agile

VABus/TCP

Communication module CM-VABus/TCP

Frequency inverter 230 V / 400 V



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1 General Information about the Documentation

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

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

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.

1.1 This document

This document describes the communication via the VABus/TCP protocol with frequency inverters of the *Agile* series of devices. Thanks to the modular hardware and software structure, the frequency inverters can be customized to meet the customer's specific requirements, including applications requiring high functionality and dynamism.



WARNING

Compliance with the documentation is required to ensure safe operation of the frequency inverter. BONFIGLIOLI VECTRON 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.

1.2 Warranty and liability

BONFIGLIOLI VECTRON GmbH would like to point out that the contents of this user manual do not form part of any previous or existing agreement, assurance or legal relationship. 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 notice. The manufacturer shall not be liable for any damage, injuries or costs which may be caused for the aforementioned reasons.

Furthermore, BONFIGLIOLI VECTRON GmbH excludes any warranty/liability claims for any personal and/or material damage if such damage is due to 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

This user manual 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 user manual and, in particular, the safety instructions in order to prevent personal and material losses.

1.4 Copyright

In accordance with applicable law against unfair competition, this user manual is a certificate. Any copyrights relating to it shall remain with

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This user manual 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 dated 09 September 1965, the law against unfair competition and the 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 form 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 this user manual 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 have 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 are 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 have their qualification verified.

Expert

The term Expert covers qualified and trained staff that have 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 2006/95/EEC and DIN EN 61800-5-1. CE-labeling is based on these standards. Responsibility for compliance with the EMC Directive 2004/108/EC 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 at all times.

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 plant operator shall bear the sole risk.

2.3.1 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. Remaining hazards are not obvious and can be a source of possible injury or health damage.

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.

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 at 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.

NOTE

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
1234	bold	Representation of parameter numbers
<i>Parameter</i>	italic, Font Times New Roman	Representation of parameter names
P.1234	bold	Representation of parameter 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 user manual 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 VECTRON 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 VECTRON 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.

2.10.5.1 The five safety rules

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

1. Isolate
2. Take appropriate measures to prevent re-connection
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 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.

3 Introduction

The present document describes the VABus/TCP protocol for the CM-VABus/TCP and CM-VABus/TCP-2P (switch function integrated) communication modules. After connecting VABus/TCP to the PLC, you can use an additional logic connection from VABus/TCP to the VPlus software running on a terminal connected via an Ethernet network.

For VABus/TCP connection, the frequency inverter must be equipped with the CM-VABus/TCP or CM-VABus/TCP-2P communication module.

The CM-VABus/TCP and CM-VABus/TCP-2P communication modules are separate components and must be attached to the frequency inverter. This is described in chapter 6.1 "Assembly".

VABus/TCP communication (as described in this manual) requires software version 6.1.0 or higher.



This manual only describes the CM-VABus/TCP and CM-VABus/TCP-2P communication modules. This manual is not to be understood as providing general/basic information on Ethernet interfaces or frequency inverters. General/basic knowledge of the methods and function of VABus/TCP interfaces and VABus/TCP protocol are a prerequisite for understanding and implementing the instructions provided by this document.



In some chapters of these instructions, setting and display options via the PC software VPlus are described as an alternative to the control unit. In this case, VPlus can use

- CM-VABus/TCP or CM-VABus/TCP-2P module **or**
- the serial interface

for communication with the frequency inverter.



The module enables using VABus/TCP via a PLC and VPlus via the VABus/TCP protocol at the same time.



WARNING

With CM-VABus/TCP or CM-VABus/TCP-2P, controllers can access **all** parameters of the frequency inverter.

Changing parameters the function of which is unknown can result in malfunction of the frequency inverter and dangerous situations in the plant.

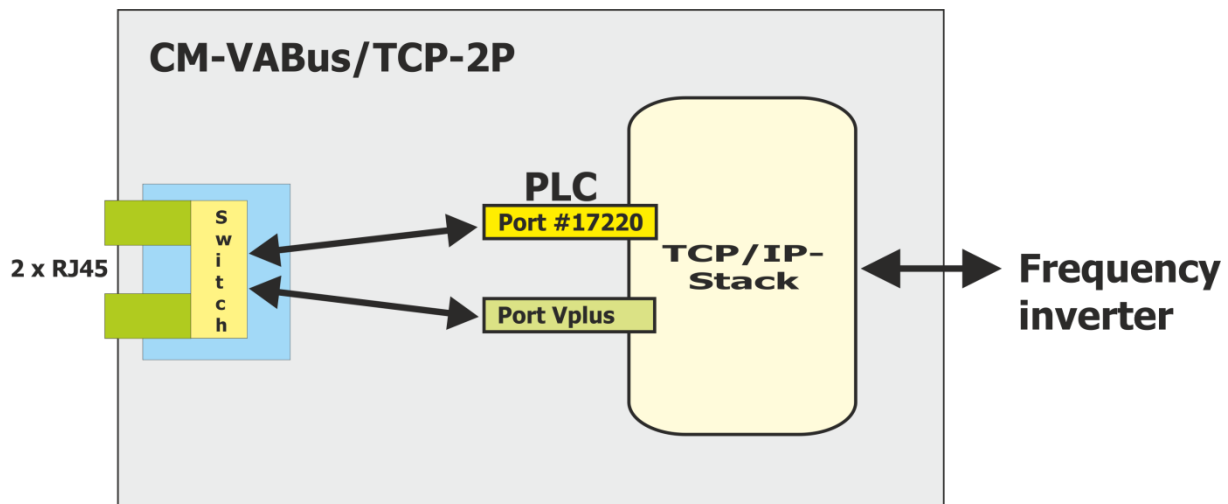
Ethernet properties:

- 10/100 MB (10Base-T/100Base-T)
- Automatic identification (Autonegotiation)
- MDI/MDIX

Ports:

The module supports two logic TCP/IP ports for VABus/TCP communication. Each port can be used for establishing **one** logic connection:

- Port #17220: Connection for PLC communication
- Port VPlus: Connection for VPlus



When a PLC starts communicating with a frequency inverter, it creates a TCP/IP source port to send data to target port #17220 of the frequency inverter. The response of the frequency inverter is sent by 17220 to this port of the PLC.

VPlus is the software for configuration and maintenance of BONFIGLIOLI VECTRON frequency inverters. It can connect with a frequency inverter while it is communicating with a PLC. VPlus can establish connections to any type of industrial Ethernet CM modules.

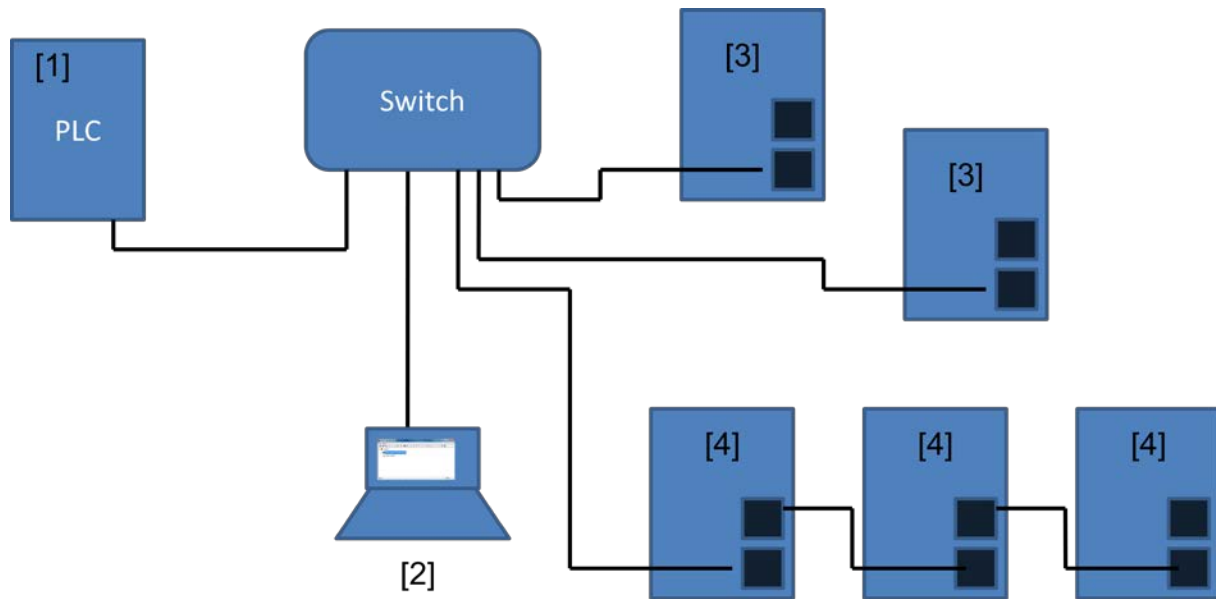
Module variants:

There are two VABus/TCP variants.

CM-VABus/TCP provides a physical interface for communication via VABus/TCP. A star-type network topology can be used. An external switch is the star point.

CM-VABus/TCP-2P provides two physical interfaces for communication via VABus/TCP. The following network topologies are possible:

- Star-type (like in CM-VABus/TCP)
- Line



- [1] PLC
- [2] PC for commissioning or diagnosis (connected temporarily or permanently)
- [3] AGL with CM-VABus/TCP or CM-VABus/TCP-2P (2nd port not connected)
- [4] AGL with CM-VABus/TCP-2P

3.1 Supported configurations

Agile frequency inverters support various types of control and reference point input:

- Contacts or remote contacts
- State machine

Contacts or remote contacts

Required settings: *Local/Remote 412* = (remote) contacts

- ➔ Control (start, stop, frequency changeover, etc.) is typically performed through
 - o digital contacts.
 - o Remote contacts via field bus.
- ➔ Reference values depend on the selected function. Typical:
 - o Reference speed/reference frequency:
 - Analog input.
 - Fixed values from parameters.
 - o Reference percentage for technology controller or torque control
 - Analog input.
 - Fixed values from parameters.

See Chapter 11 "Control of frequency inverter".

State machine:

Required settings: *Local/Remote 412* = 1 – State machine

- ➔ Control (start, stop, change of mode, etc.) is performed via *Control word 410*.
- ➔ Reference values depend on the selected function. Typical:
 - o Reference speed/reference frequency:
 - Analog input.
 - Fixed values from parameters.
 - o Reference percentage for technology controller or torque control
 - Analog input.
 - Fixed values from parameters.

3.2 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 20 seconds.



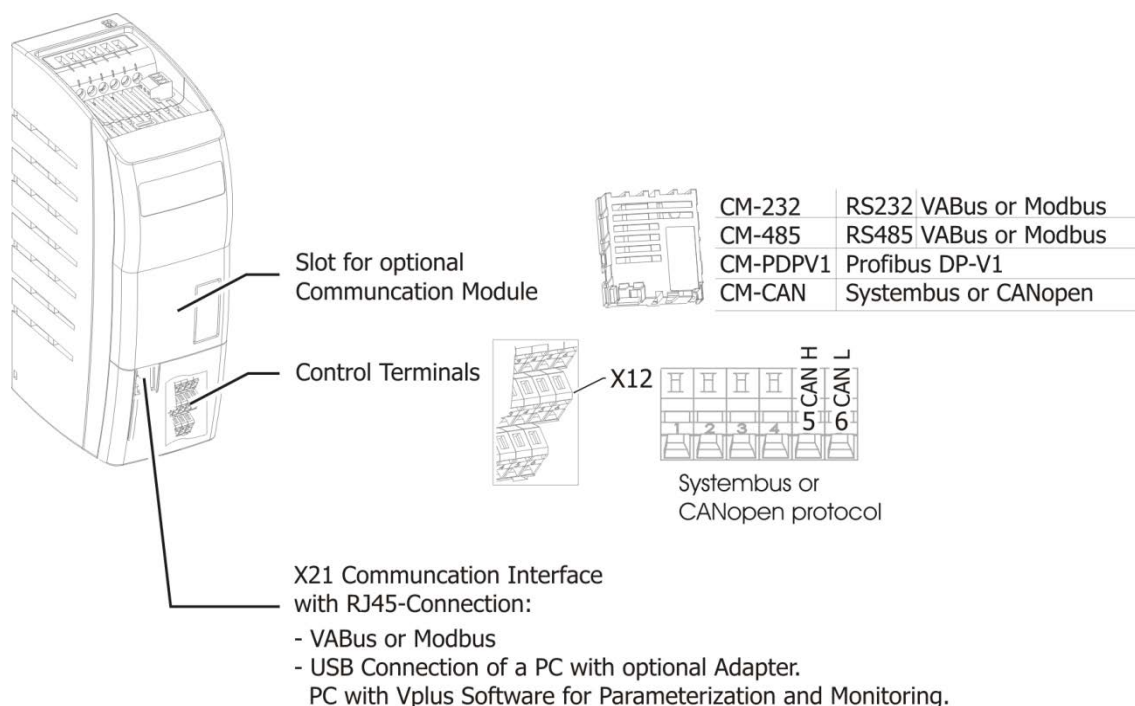
Wait until the initialization phase is complete before starting the communication (RUN LED).

4 First commissioning

For first commissioning, you should be familiar with the followings steps and the described functions:

- | | |
|---|-----------------------|
| • Installation of module | Chapter 6.1 |
| • Selection of device control <i>Local/Remote 412</i> | Chapter 11 |
| • Commissioning of device functions via PLC | |
| o Fault Reaction | Chapter 7.5 |
| ▪ Fault reset | Chapter 8.4 |
| • Setting reference values: | |
| o Reference Frequency | Chapter 11.3.2 |
| • Diagnosis: | Chapter 13.1 and 14.1 |

5 Communication options



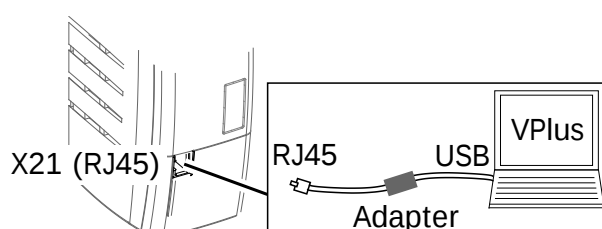
Interface	See
CAN connection control terminals CM-CAN	Instructions on Systembus or CANopen®.
Communication interface X21 CM-232	Instructions on VABus or Modbus.
CM-485	Instructions on VABus or Modbus.
CM-PDPV1	Instructions on Profibus DP-V1.
CM-DEV	Instructions on DeviceNet.
CM-VABus/TCP	Instructions on VABus/TCP.
CM-EtherCAT	Instructions on EtherCAT®.
CM-EtherNet/IP	Instructions on EtherNet/IP.
CM-Modbus/TCP	Instructions on Modbus TCP.
CM-PROFINET	Instructions on PROFINET.

Combinations of Systembus and CANopen® communication at the two interfaces:

Optional communication module (CM)	Frequency inverter terminals X12.5 and X12.6
CANopen®	and (at the same time) Systembus
Systembus	and (at the same time) CANopen®

5.1 Control software VPlus:

Via an optional USB adapter, you can connect an USB interface of a PC to the X21 communication interface. This enables configuration and monitoring using the PC software VPlus.



6 Assembly/disassembly of communication module

6.1 Assembly

The CM-VABus/TCP and CM-VABus/TCP-2P communication modules are pre-assembled in a case and are ready for installation. In addition, a PE-spring is supplied for PE-connection (shield).



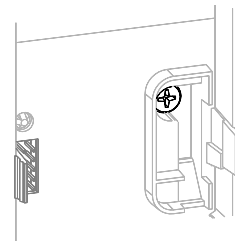
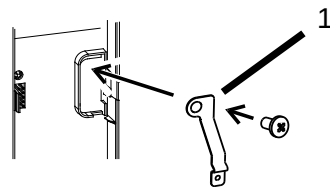
CAUTION

Danger of destruction of frequency inverter and/or communication module

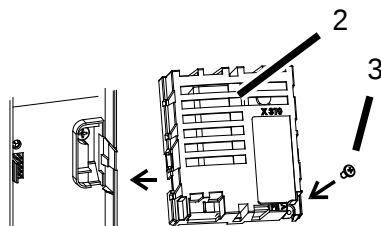
- Before installation of the communication module, the frequency inverter must be disconnected from power supply. Installation is not permissible while the unit is energized.
- Do not touch the PCB visible on the back of the module, otherwise components may be damaged.

Work steps:

- Disconnect the frequency inverter from mains voltage and protect it against being energized unintentionally.
- Remove the cover of the module slot.
- Fix the PE-spring (1). Use the screw provided at the frequency inverter.



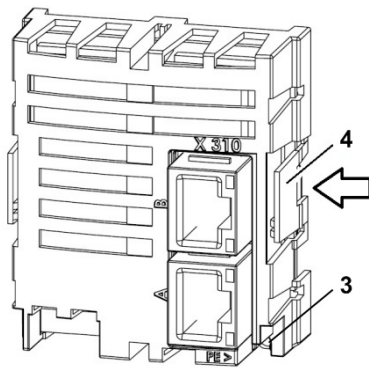
- Insert the communication module.
- Fix the communication module (2) at the frequency inverter using the screw (3).



- Break out the pre-punched cut-out from the cover.
- Fix the cover again.

6.2 Disassembly

- Disconnect the frequency inverter from power supply and protect it against being energized unintentionally.
- Remove the cover of the module slot.
- Loosen the screw (3) at the communication module.
- Using a small screwdriver, unlock the hooks (4) (first right then left).

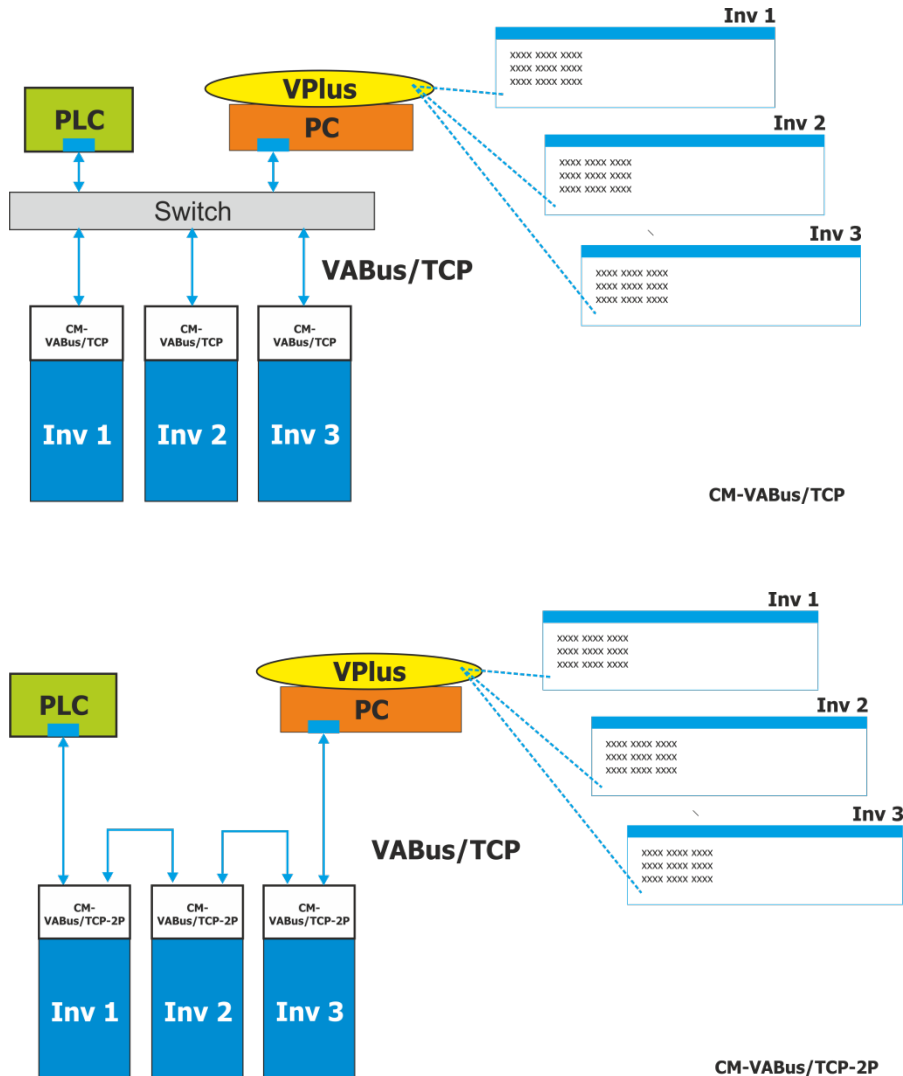


- Pull communication module out of slot.
- Unscrew PE-spring.
- Fix the cover on the frequency inverter.

7 VABus/TCP interface

The frequency inverter can be controlled by a PLC or another master device via an Ethernet interface using the VABus/TCP protocol.

When a VABus/TCP or VABus/TCP-2P communication module is used, you can also access the frequency inverter using the VPlus software via Ethernet. VPlus can be used in parallel with a PLC with VABus/TCP communication.



This document does not provide basic information about Ethernet interfaces. Basic knowledge of Ethernet is required. This document describes the special properties of the VABus/TCP protocol.

In some sections, setting and display options via the PC software VPlus are described as an alternative to the control unit. In this case, VPlus communicates with the frequency inverter via a serial interface or a direct Ethernet connection.



WARNING

With VABus/TCP communication, controllers can access **all** parameters of the frequency inverter.

Changing parameters the function of which is unknown can result in malfunction of the frequency inverter and dangerous situations in the plant.



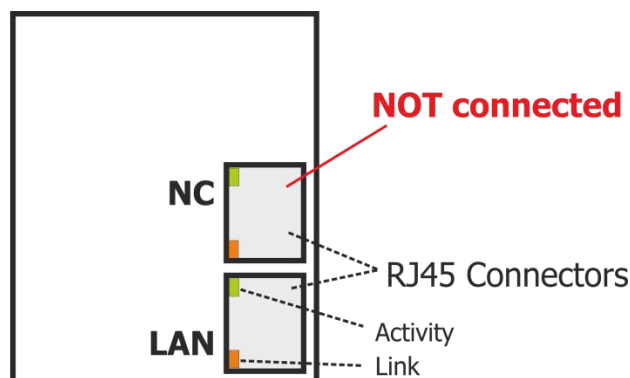
CAUTION

When values are to be written cyclically at a high repetition rate, no entries shall be made in the EEPROM, as this only allows a limited number of write cycles (approx. 1 million cycles). If the number of permissible write cycles is exceeded, the EEPROM will be damaged. See chapter 9.1 "Handling of datasets / cyclic writing of parameters".

7.1 Communication modules

CM-VABus/TCP

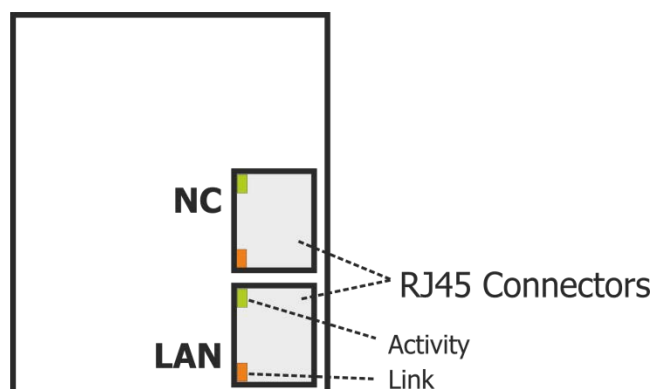
The CM-VABus/TCP communication module features an active RJ45 port.



CM-VABus/TCP

CM-VABus/TCP-2P

The CM-VABus/TCP-2P communication module features two active RJ45 ports with integrated switching function. This enables easy linking (daisy chain) of frequency inverters which are connected to a PLC.



CM-VABus/TCP-2P

7.1.1 Installation instructions

The VABus/TCP module is connected to the PLC or other devices using standard CAT cables and RJ45 connectors:

Ethernet standard: IEEE 802.3, 100Base-TX (fast Ethernet)

Cable type: S/FTP (cable with braided shield, (ISO/IEC 11801 or EN 50173, CAT5e Straight Through or Cross Over)

7.2 Setup

By default, the parameters of the CM-VABus/TCP and CM-VABus/TCP-2P communication modules are set up as follows:

Parameters		Settings
No.	Description	Factory setting
388	<i>Bus Error Behaviour</i>	1
1432	<i>IP-Address</i>	172.22.1.25
1433	<i>Netmask</i>	255.255.255.0
1434	<i>Gateway</i>	0.0.0.0
1435	<i>DNS Server</i>	0.0.0.0
1436	<i>DHCP Option</i>	0
1437	<i>IP Command</i>	-
1440	<i>Email Function</i>	0
1441	<i>Email Text (Body)</i>	-

The parameter settings must be adapted to the actual application.

7.3 TCP/IP address & subnet

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

7.3.1 Network without DHCP server:

The address is set via parameter *IP-Address* **1432**. In addition, the subnet mask-*Netmask* **1433** must be entered properly for the local network.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
1432	IP address	0.0.0.0	255.255.255.255	172.22.1.25
1433	Netmask	0.0.0.0	255.255.255.255	255.255.255.0

7.3.2 Network with DHCP server:

When a DHCP server is used, manual network configuration is not required. Set *DHCP Option* **1436** to "1-Enabled" if you wish to use the DHCP function.

DHCP Option 1436	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.

7.4 TCP/IP configuration

In order to establish connection with a frequency inverter featuring a CM-VABus/TCP module, you will have to configure IP settings for the CM-VABus/TCP module.

TCP/IP configuration can be performed in different ways.

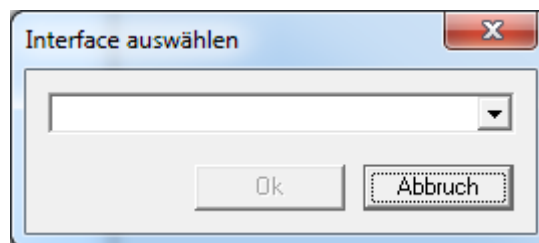
- TCP/IP configuration program, see Chapter 7.4.1 “TCP configurations tool”.
- Parameter settings with VPlus via service port of frequency inverter (KP232), see Chapter 7.4.2.1 “Basic IP settings”.
- Control panel.

7.4.1 TCP configurations tool

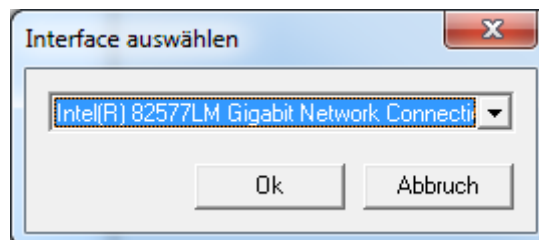
There are different ways to start the “TCP configuration tool”:

- In the “Inverter Manger” window click on the “Start TCP configuration tool”.
- Double-click on the desktop icon “Vectron Network Configuration” (stand-alone application).

Once the application has started, a window will appear where you can select the Ethernet adapter via which the frequency inverter is connected:

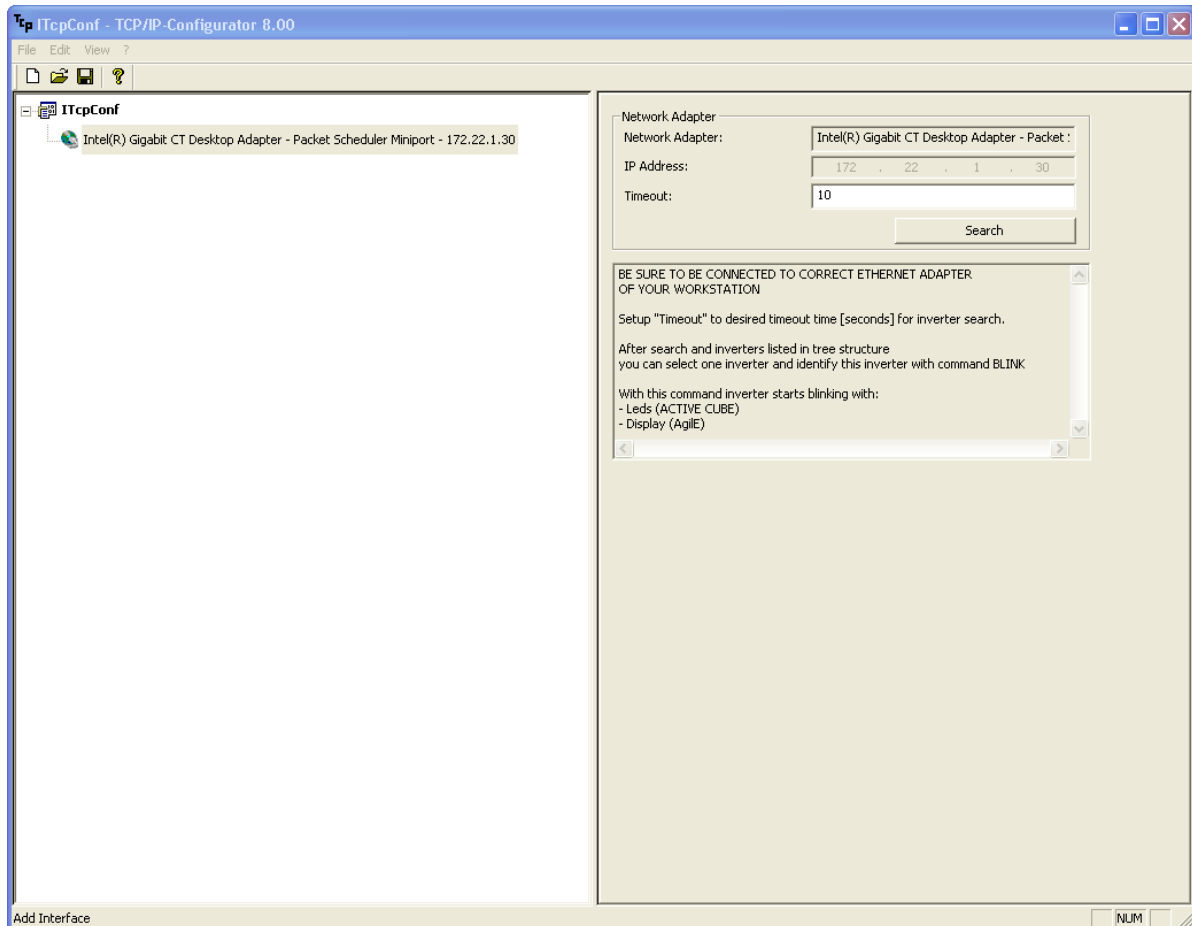


- Select the Ethernet adapter and click on “Ok”.



Once the Ethernet adapter has been selected, the configuration program is ready to search for available frequency inverters.

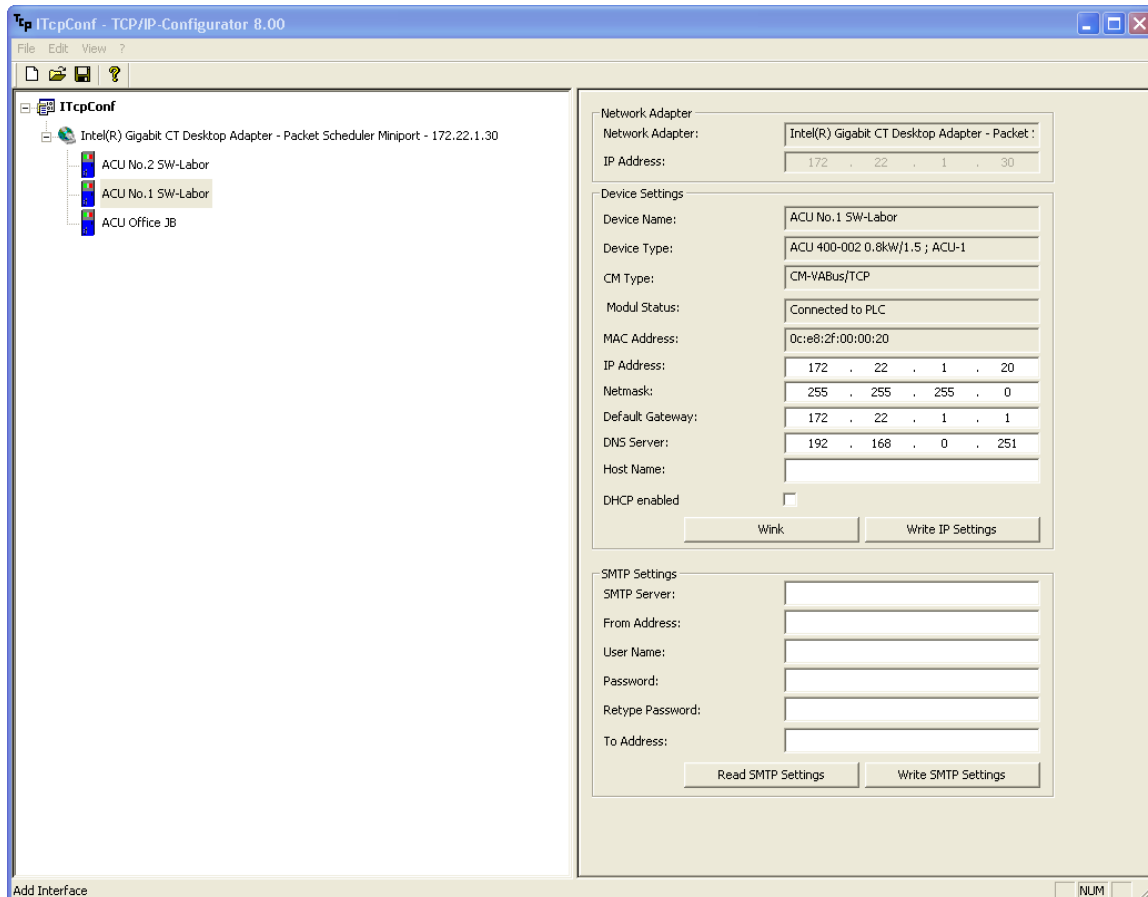
With the “Timeout” setting, you define how long the TCP configuration tool will wait for responses from the frequency inverter.



- In the “Timeout” field, enter the required time and click on “Search”.

The search is started. Upon completion of the search all frequency inverters found will be listed in the left area of the window.

- Click on the frequency inverter to be configured.



The right part of the window shows information on the device and input fields for various settings.

Information about network adapter:

Network adapter:	Name of selected network adapter.
IP address:	IP address of network adapter.

Device information:

Device name:	Device name from frequency inverter parameter <i>User name 29</i> .
Device type:	Type of frequency inverter.
CM type:	Type of CM module, i.e.: CM – VABus/TCP.
Module status:	Current status of CM module, e.g. “Connected to PLC”.
MAC address:	MAC address of CM module.

Device settings

IP address:	Current IP address of device.
Subnet mask:	Current subnet mask.
Standard gateway:	Address of standard gateway.
DNS Server:	Address of current DNS server.
Host Name:	Name of host.
DHCP activated:	Use of DHCP (yes/no).

- Enter the device settings required for your application. In order to apply the settings to the device, click on “Write IP settings”.

NOTE

Before clicking on “Write IP settings”, make sure that you are connected with the right frequency inverter. To check this, click on the “Wink” button. The connected frequency inverter will flash for 10 seconds.

At the frequency inverter, you can activate a function which will send an e-mail in case of an error. In addition, a short text can be entered and saved as the e-mail text. The required settings can only be made via VPlus. VPlus will access the frequency inverter via a local service port (KP232) or an Ethernet connection.

To configure the e-mail function, please refer to Chapter 7.4.2.2 “Email”.

To send an e-mail message, the frequency inverter needs various information. It must have its own e-mail address from where the e-mail message is sent. For e-mail transmission, identification by the SMTP server (user name and password) is required. The recipient of the e-mail message must be known.

In addition, the local network must be connected to the Internet, i.e. Gateway and DNS server must be entered correctly. If you have any questions or problems, please contact your local system administrator.

SMTP settings (examples):

SMTP server:	<i>smtp.provider.com</i>
“From” address:	<i>inverter.drive1@company.com</i>
User name:	<i>drive1@company.com</i>
Password:	<i>password</i>
Re-enter password	<i>password</i>
“To” address	<i>service.drives@company.com</i>

SMTP settings saved before can be viewed by clicking on the “Read SMTP settings”. The password will **not** be displayed.

SMTP settings are applied to the module by clicking on the “Write SMTP settings”. When the SMTP settings are written, you will be prompted to enter a password. The two input fields “Password” and “Re-enter password” must contain the same character sequence. If no entry is made or the contents of the two input fields are different, an error message will be displayed.

NOTE

- All **device settings** are saved in the module **and** in the non-permanent memory of the frequency inverter. Switching of modules from one frequency inverter to another does not have an effect on the IP settings of the frequency inverter. A PLC will remain connected with the right frequency inverter after switching of the module.
- **SMTP settings** are saved in the module only. Switching of modules from one frequency inverter to another will result in malfunction:
 - o No e-mail messages will be sent in case of an error.
 - o Wrong recipient.
 - o Wrong e-mail text.

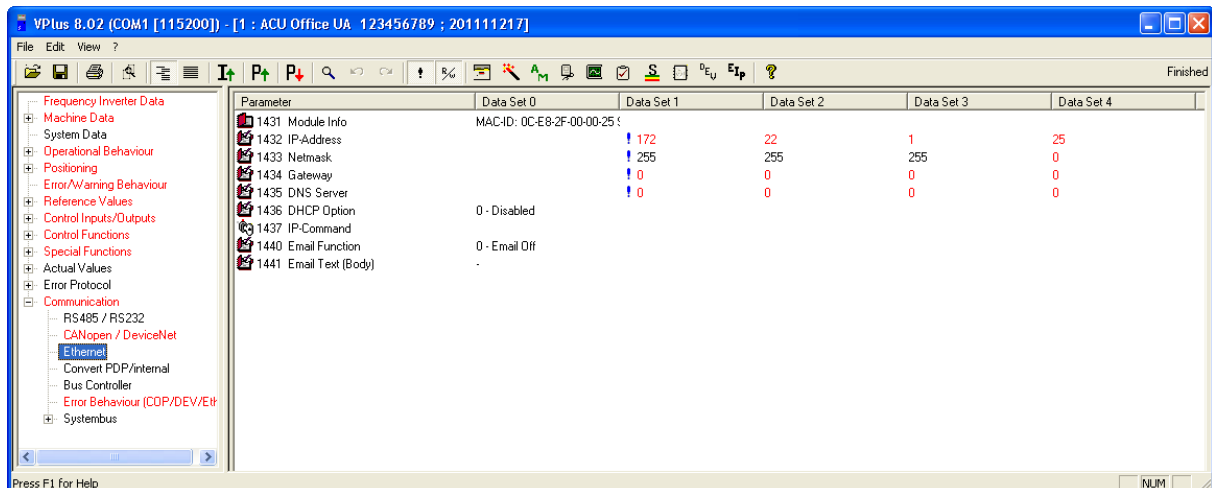


For documentation, all settings can be saved in a file (type = *.eop).

7.4.2 Parameter settings with VPlus

7.4.2.1 Basic IP settings

IP settings can be made via the interface X21 and the USB/Com Port adapter. Various parameters are available for module information and IP settings.



Parameter *Module Info 1431* shows basic module data:

MAC-ID: unambiguous MAC-ID
Sno: Serial number
HW: Hardware version
SW: Software version

For IP setting, five parameters are available.

Parameters	
No.	Description
1432	IP address
1433	Netmask
1434	Gateway
1435	DNS Server
1436	DHCP Option

They define the IP settings and/or use of DHCP. When the DHCP option is activated, the IP settings will be made by the DHCP server when the module is started.

Each setting comprises four values. Please contact your IT administrator for permissible values. The four values of the parameters are assigned on the display to four datasets ("Data Set 1" to "Data Set 4"). However, they **do not** depend on changes of these data sets directly. The datasets are only provided for clear representation of the values.

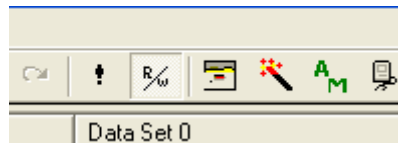
- To make IP settings, click on the first entry (e.g. Parameter **1432** *IP-Address* "Data Set 1").
- Enter the required value and go to the next input field by pressing the "TAB" button.



The new settings will be saved in a buffer memory, but not transmitted to the module. On the network side, they will not be active.

In the case of incorrect entries, the values can be overwritten. Old values can be restored via parameter **1437 IP-Command** = "1 – Reload IP-Settings".

The "R/W" activates the "Update all parameters in current window regularly" function:



NOTE

Before applying the new IP settings to the module, make sure that the "R/W" button is activated.

- Apply the new IP settings to the module via parameter **1437 IP-Command** = "0 – Apply".



The module will reject non-permissible IP settings and will restore the last permissible settings automatically. After execution of the "Apply" command, all IP settings will be reset and the new settings will be overwritten by the old settings.

7.4.2.2 Email

When an error occurs in the frequency inverter, an e-mail message can be sent automatically to report the incident to the Service department, for example. To activate the e-mail function and define the e-mail text, two parameters are used:

Parameters	
No.	Description
1440	<i>Email Function</i>
1441	<i>Email Text (Body)</i>

The contents of the e-mail message is pre-defined. The reference heading is given and cannot be edited.

Reference: Frequency inverter type, frequency inverter name (from parameter **29 User name**), IP address, error number

E-mail text: Optional text (max. 40 characters), defined in parameter **1441 Email Text (Body)**.

Example:

Reference: AGL Main Drive machine no. 5, 172.22.5.145, F0400
Please contact Mr. Doe, extension 2121.

7.5 Operating behavior in the case of a communication error

The operating behavior in the case of errors in VABus/TCP communication can be parameterized. The required behavior can be set up via *Bus Error Behaviour 388*.

<i>Bus Error Behaviour 388</i>	Function
0 - no response	Operating point is maintained.
1 - Error	"Fault" status will be activated immediately. Factory setting.
2 - Stop	Control command "Disable voltage" and switch to "switch on disabled" status.
3 - Quick stop	Control command "Quick stop" and switch to "switch on disabled" status.
4 - Shutdown + Error	Control command "Disable operation" and switch to "Error" status once the drive has been shut down.
5 - Quick stop + Error	Control command "Quick stop" and switch to "Error" status once the drive has been shut down.



The parameter settings *Bus fault behavior 388* = 2...5 are evaluated depending on parameter *Local/Remote 412*.

For evaluation of settings 2...5, parameter *Local/Remote 412* must be set to value "1 - Control via statemachine".

8 Protocol

The VABus protocol was originally developed for the serial interface (RS232/RS485) and adapted to the CM-VABus/TCP module. The VABus/TCP protocol uses the TCP/IP protocol. The VABus data is integrated in the data block of the TCP/IP protocol. VABus/TCP and VABus use a similar structure. The handshake procedures and the data representation are different. VABus uses HEX-ASCII data, while VABus/TCP uses binary data. The protocol structure of VABus/TCP aims at fast processing and minimum protocol overhead.

➔ Read/write commands and VABus/TCP data are integrated in the TCP/IP data range.

The VABus and VABus/TCP protocol enable operation as a pure Master/Slave system. A PC, a PLC or any type of computer system is the bus Master.

Two types of requests are used:

Send request (inquiry telegram) for the request for reading parameters in the frequency inverter by the bus Master.

Enquiry request (select telegram) for handing over parameter values or parameter settings to the frequency inverter by the bus Master.

Send/positioning requests and send/positioning responses use defined data structures which are arranged in frames. Each frame comprises a header byte and different numbers of bytes containing information for parameter access.

The header byte is divided in 8 control bits, only bits 6 and 7 are used. Bits 0 to 5 are not used and must have value "0". If one or more of these bits has/have value "1", the error message "syntax error in received telegram" will be returned as the response.

8.1 Telegram types

8.1.1 Data types

The number of data bytes depends on the type of the corresponding parameter. A maximum of 99 data bytes can be transferred.

Data Types Used				
Data type abb.	Type	Number of data types "w"	Value	Bit number
uInt	unsigned Integer	04	0 ... 65535	16
Int	Integer	04	-32768 ... +37767	16
Long	Long	08	$-2^{31} \dots +2^{31}-1$	32
String	string of characters	variable, up to 99	-	variable



Parameter values with decimal places are transferred without decimal point. Depending on the number of decimal places, the values are multiplied by 10, 100 or 1000. The number of decimal places for the corresponding parameters is set in the frequency. In this way it is made sure that the sent parameter values are processed correctly.

Example: Frequency value with data type long:

Value to be transferred = 100.25. The numerical value transmitted in the telegram is 10025, which corresponds to 0x2729 in HEX format. Since the data type is **long**, 8 data bytes are transferred ("wwwwww").

➔ 00002729

Example: Current value with data type Int:

The value to be transmitted is 10.3 A. The numerical value transmitted in the telegram is 103, which corresponds to 0x67 in HEX format. Since the data type is **int**, 4 data bytes are transferred ("www").

➔ 0067

8.1.2 Send Request / Enquiry Telegram

Send request PLC → frequency inverter:

Byte	0			1	2	3	4	5
	Header			NoB	SYS	DS	P.-No.	
	7	6	5...0				LSB	MSB
	R/W	0	0	4	nn	nn	nnnn	

Header: Bit 7 **R/W** **0 = Send request**

NoB: Byte number Number of relevant bytes ([Byte 2] – [Byte 5])
NoB will always be “4” for send requests.

SYS: Addresses frequency inverters which are connected to a TCP/IP module via CAN System Bus.
SYS = 0 for direct addressing of frequency inverter in Ethernet connection (SYS = 0...63)

DS: Data set number of parameter (0, 1 ... 4)

P. No.: Parameter number (0 ... 1599)

Send response frequency inverter → PLC:

Byte	0			1	2	3	4	5	6	7	8	9	...	n		
	Header			NoB	SYS	DS	P.-No.		data							
	7	6	5...0				LSB	MSB	uint / int data							
	R/W	E	0	nn	nn	nn	nnnn		LSB	MSB						
									long data							
									LSB				MSB			
									string data							
								first character					last character			

Header: Bit 7 **R/W** **0 = Send response**

Bit 6 **E** 0 = no error
1 = error
if (E == 1) → byte 6+7 contains error code (→ NoB = 6)

NoB: Byte number Number of relevant bytes

SYS: returns value SYS from the request frame

DS: returns dataset number from the request frame

P. No.: returns parameter number from the request frame

data: requested parameter value, byte number depending on data type

If no response from the frequency inverter is received within a given response time (see chapter 8.3, "Timeout control"), or if the frequency inverter returns incorrect data, the inquiry telegram is repeated three times (maximum of three transmissions possible).

NAK signals an error. An error may have different causes. Errors may be caused by incorrect data or an incorrect string.

8.1.3 Setting Request / Select Telegram

Via the select telegram, the data are sent to the frequency inverter.

Positioning request PLC → frequency inverter:

Byte	0			1	2	3	4	5	6	7	8	9	...	n		
	Header			NoB	SYS	DS	P.-No.		data							
	7	6	5...0				LSB	MSB	uint/int data							
	R/W	0	0	nn	nn	nn	nnnn		LSB	MSB						
											long data					
											LSB			MSB		
											string data					
											first character					last character

Header: Bit 7 **R/W** **1 = Setting request**

NoB: Byte number Number of relevant bytes
([Byte 2] ... [Byte 5] + Number of data bytes)

SYS: Addresses frequency inverters which are connected to a TCP/IP module via CAN System Bus.
SYS = 0 for direct addressing of frequency inverter in Ethernet connection

DS: Data set number of parameter (0,1 ..., 4, 5, 6 ... 9)

P. No.: Parameter number (0 ... 1599)

data: parameter value to be written, byte number depending on data type

Setting response frequency inverter → PLC:

Byte	0			1	2	3	4	5	6	7	8	9	...	n		
	Header			NoB	SYS	DS	P.-No.		data							
	7	6	5...0				LSB	MSB	uint/int data							
	R/W	E	0	nn	nn	nn	nnnn		LSB	MSB						
											long data					
											LSB			MSB		
											string data					
										first character					last character	

Header: Bit 7 **R/W** **1 = Setting response**

Bit 6 **E** 0 = no error
1 = error
if (E == 1) → byte 6+7 contains error code (→ NoB = 6)

NoB: Byte number Number of relevant bytes
([Byte 2] ... [Byte 5] + number of data bytes)

SYS: returns value SYS from the request frame

DS: returns dataset number from the request frame

P. No.: returns parameter number from the request frame

data: returns written parameter value, byte number depending on data type

8.1.4 System bus Node-ID

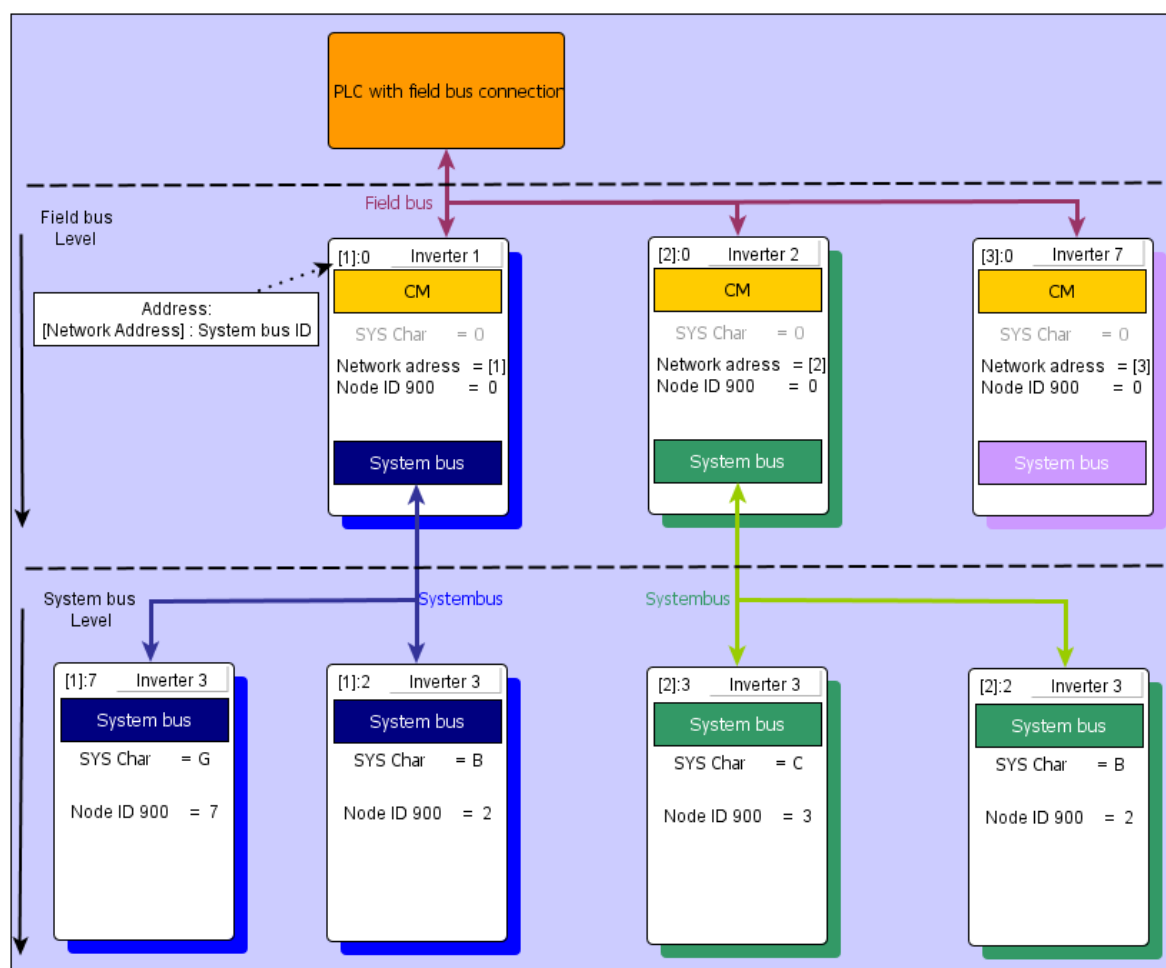
The System Bus *Node-ID* 900 is required for addressing networked inverters. If there is no System Bus, or if the System Bus master is addressed, the SYS character is always filled with the zero character (**0x30**). The *Node-ID* **900** has values ranging from 0 to 63.

<i>Node-ID</i> 900	Function	SYS character
-1	No System Bus at inverter.	"-1" = 0xFFFF
0	The inverter is the System Bus master.	"0" = 0x30
1 ... 63	The inverter is the System Bus slave with the specified ID.	0x41 .. 0x7F

If the *Node-ID* **900** is not zero, the SYS character is determined as follows:

$$\text{SYS character} = (\text{char})(\text{SysNode-ID Nr} + 0x40)$$

For example, *Node-ID* **900** of **7** will result in character 0x47 = "**G**". Refer to System Bus description.



The procedure shown in the illustration will work in the following Field Buses:

- VABus
- VABus/TCP

Instead of the PLC, you can use a standard PC with an appropriate interface.

The addresses in a System Bus branch must be assigned unambiguously. Since several System Bus branches can operate independently due to the different Ethernet clients, identical System Bus addresses are possible in the network. The distinction is made based on the different Ethernet addresses.

In the case of VABus, the network address is a serial address ranging from 1 to 127.

In the case of VABus/TCP, the network address is an IP address in the format aaa.bbb.ccc.ddd, with each block of numbers ranging from 0 to 255.

8.2 Telegram check

The frequency inverter and the bus Master check the telegrams for correctness. Depending on the type of telegram, the corresponding reaction takes place. The telegrams are checked for correct syntax, address and text part (content, checksum).

In case the telegram contains errors, the frequency inverter either returns NAK or it does not respond at all. The possible causes are listed below:

no response wrong telegram structure
 wrong control character
 wrong address
 telegram addressed to address 32 (Broadcast); in this case, the frequency inverter does not reply.

If an error occurs during parameter access, the frequency inverter will return an error message (Bit E = "1" in read/write response). Bytes 6 and 7 contain the error code.

<i>VABus SST-Error-Register 11</i>	
Error no.	Meaning
0	no error
1	Non-permissible parameter value.
2	Non-permissible dataset
3	parameter not readable (write-only)
4	parameter not writable (read-only)
5	EEPROM read error
6	EEPROM write error
7	EEPROM checksum error
8	Parameter cannot be written while drive is running
9	Values of data sets are different
10	not available
11	unknown parameter
12	not available
13	Syntax error in received telegram
14	data type of parameter does not correspond to the number of bytes in the telegram
15	unknown error
20	selected System Bus node not available
30	Syntax error in received telegram

8.3 Timeout control

After first data exchange via the PLC Port #17220, a timeout check will be activated. If no data is exchanged for more than 10 seconds, the frequency will respond in the way set in parameter *Bus Error Behaviour 388*. and switch to fault status with error message F2714 "Communication Loss to PLC".

<i>Bus Error Behaviour 388</i>	Function
0 - no response	Operating point is maintained.
1 - Error	"Fault" status will be activated immediately. Factory setting.
2 - Stop	Control command "Disable voltage" and switch to "switch on disabled" status.
3 - Quick stop	Control command "Quick stop" and switch to "switch on disabled" status.
4 - Shutdown + Error	Control command "Disable operation" and switch to "Error" status once the drive has been shut down.
5 - Quick stop + Error	Control command "Quick stop" and switch to "Error" status once the drive has been shut down.



The parameter settings *Bus Error Behaviour 388* = 2...5 are evaluated depending on parameter *Local/Remote 412*.

For evaluation of settings 2...5, parameter *Local/Remote 412* must be set to value "1 - Control via statemachine".

8.4 Resetting errors

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

- In controller via Parameter *Local/Remote 412* = 1 - Statemachine:
Set bit 7 *Control word 410* = 0x8000.
- By pressing the stop button of the control panel:
Resetting by pressing the STOP button is only possible if Parameter *Local/Remote 412* permits control via the control panel.
- Via parameter *Error acknowledgment 103* which is assigned a logic signal or a digital input
A reset via a digital signal can only be carried out when parameter *Local/Remote 412* permits this or when an input with the addition (hardware) is selected in the case of physical inputs.



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

9 Parameter access

9.1 Handling of datasets / cyclic writing of parameters

The parameter values are accessed based on the parameter number and the required dataset. There are parameters the values of which are present once (dataset 0) as well as parameters the values of which are present four times (dataset 1...4). These are used for dataset switching.

If parameters which are present four times in the datasets are set to Dataset = 0, the four datasets are set to the same transmitted value. A read access with data set = 0 to such parameters is only successful if all four data sets are set to the same value. If this is not the case, an error will be signaled.

NOTE

The values are entered automatically in the EEPROM of the controller. When values are to be written cyclically, no entries shall be made in the EEPROM, as this only allows a limited number of write cycles (approx. 1 million cycles). When the number of permissible write cycles is exceeded, the EEPROM will be destroyed.

In order to avoid this, data which is written cyclically can be entered in the RAM exclusively without a writing cycle on the EEPROM. Such data will be lost in the case of a power failure and have to be written again after Power off/on.

This mechanism is started when the target dataset is increased by five when specifying the dataset.

Writing on virtual dataset in RAM

Parameters	EEPROM	RAM
Dataset 0	0	5
Dataset 1	1	6
Dataset 2	2	7
Dataset 3	3	8
Dataset 4	4	9

9.2 Handling index parameters / cyclic writing

Index parameters are used for various AGL functions. Here, 16 or 32 indexes are used instead of the 4 data sets. For each function, the individual indexes are addressed separately via an index access parameter. Via the indexing parameter, you can select if the data is to be written to EEPROM or RAM.

Function	Parameters	Index range		Indexing parameters
		Write EEPROM and read	Write RAM	
PLC function (Function Table)	1343 <i>FT-Instruction</i> 1344 <i>FT-Input 1</i> 1345 <i>FT-Input 2</i> 1346 <i>FT-Input 3</i> 1347 <i>FT-Input 4</i> 1348 <i>FT-Parameter 1</i> 1349 <i>FT-Parameter 2</i> 1350 <i>FT-Target Output 1</i> 1351 <i>FT-Target Output 2</i> 1352 <i>FT-Commentary</i>	0 ¹⁾ ; 1...32	33 ¹⁾ ; 34...65	1341 Write 1342 Read
Multiplexer	1252 <i>Mux Input</i>	0 ¹⁾ ; 1...16	17 ¹⁾ ; 18...33	1250 Write 1251 Read
CANopen® Multiplexer	1422 <i>CANopen Mux Input</i>	0 ¹⁾ ; 1...16	17 ¹⁾ ; 18...33	1420 Write 1421 Read

1) When the indexing parameter = 0, all indexes will be written upon parameter access in EEPROM. 17 or 33 will write all indexes in RAM.

NOTE

The values are entered automatically in the EEPROM of the controller. However, 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.

- Values which are written cyclically at a high repetition rate should be written to the RAM and not the EEPROM.

In the RAM, the data is not protected against loss of power. Once power supply is disrupted, the data must be written again.

This procedure is started when the target data set is increased by five when specifying the data set (IND).

9.2.1 Example: Writing of index parameters

Typically, index parameters are written during commissioning.

Writing of Parameter **1344** *PLC Input 1* (Type int), in Index 34 in RAM (→ Index 34 for write access) with parameter value 2380.

Index = 1341 + 0x2000 = 0x253D, value (int) = 34 = 0x0022

Index = 1344 + 0x2000 = 0x2540, value (int) = 2380 = 0x094C



If various parameters in an index are to be edited, it will be sufficient to set index access via **1341** once first.

9.2.2 Example: Reading of index parameters

In order to read an index parameter, you will have to set the indexing parameter to the relevant index first, then you can read the parameter.

Reading from parameter *PLC input 1* **1344** type int), in Index 1 with parameter value 6.

Index = 1342 + 0x2000 = 0x253E, value (int) = 1 = 0x0001

Index = 1344 + 0x2000 = 0x2540, value (int) = 6 = 0x0006



If various parameter of an index are to be read, it will be sufficient to set index access via **1342** once first.

10 Example messages VABus/TCP

This chapter describes some examples of telegrams for VABus/TCP.

10.1 Reading parameters

Example 1:

Reading of parameter *Rated speed* **372** (0x0174) in dataset2.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.	
	> 40 Bytes	7	6	5...0				LSB	MSB
		0	0	0	04	00	02	74 01	

Response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data	
	> 40 Bytes	7	6	5...0				LSB	MSB	uint/int data	
										LSB	MSB
		0	0	0	06	00	02	74 01		6E	05

The sent hexadecimal value is 0x056E = Decimal 1390. Parameter *Rated speed* **372** has no decimal places. Thus, the rated speed is 1390 min⁻¹.

Example 2:

Reading of parameter *Fixed frequency 2* **481** (0x01E1) in dataset 1.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.	
	> 40	7	6	5...0				LSB	MSB
	Bytes	0	0	0	04	00	01	E1 01	

Response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7	8	9
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data			
	> 40 Bytes	7	6	5...0				LSB	MSB	long data			
		0	0	0	08	00	01	E1 01		E8	03	00	00

The sent hexadecimal value is 0x03E8 = Decimal 1000. Parameter *Fixed frequency 2* **481** has two decimal places. Thus, the frequency is 10.00 Hz.

Example 3:

Reading of parameter *Inverter software version* **12** (0x000c) in dataset 0.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.	
	> 40 Bytes	7	6	5...0				LSB	MSB
		0	0	0	04	00	00	0c 00	

Response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7	8	9	10	11	12	13	14
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data								
	> 40 Bytes	7	6	5...0				LSB	MSB	String data (hexadecimal and string)								
		0	0	0	0D	00	00	01	E1	36	2E	32	2E	30	20	53	54	4F
										6	.	2	.	0		S	T	O

The sent hexadecimal value is ASCII encoded. In the example, the ASCII string is green. For conversion between hexadecimal and ASCII value, refer to the relevant table in the appendix.

10.2 Writing parameters

Example 1:

Writing of parameter *Rated mech. power* **376** (0x0178) in dataset 4.

The rated mechanical power is to be set to 1.50 kW. Parameter *Rated mech. Power* **376** has two decimal places. Thus the value to be sent is 150 = 0x0096.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5	6	7
	TCP/IP	Header			NoB	SYS	DS	P.-No.		data	
	> 40 Bytes	7	6	5...0				LSB	MSB	uint/int data	
		1	0	0	06	00	04	78 01	96		00
										LSB	MSB

Response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data	
	> 40 Bytes	7	6	5...0				LSB	MSB	uint/int data	
		1	0	0	06	00	04	78 01	96		00
										LSB	MSB

The response is the reflected signal of the request message.

Example 2:

Writing of non-permissible value 0 in parameter *Rated mech. power* **376** (0x0178) in dataset 2.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5	6	7
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data	
	> 40 Bytes	7	6	5...0				LSB	MSB	uint/int data	
		1	0	0	06	00	04	78 01		00	00

Error response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data	
	> 40 Bytes	7	6	5...0				LSB	MSB	uint/int data	
		1	1	0	06	00	04	78 01		01	00

Example 3:

Writing of parameter *Fixed frequency 3* **482** (0x01E2) in dataset 9 (= RAM for dataset 4) of frequency inverter.

The fixed frequency is to be set to 44.50 Hz. Parameter *Fixed frequency 3* **482** has two decimal places. Thus the value to be sent is 4450 = 0x00001162.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5	6	7	8	9
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data			
	> 40 Bytes	7	6	5...0				LSB	MSB	long data			
		1	0	0	08	00	09	E2 01		62	11	00	00

Response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7	8	9
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data			
	> 40 Bytes	7	6	5...0				LSB	MSB	long data			
		1	0	0	08	00	09	E2 01		62	11	00	00

The response is the reflected signal of the request message.

Example 4:

Writing of parameter *Fixed frequency 3 482* (0x01E2) in dataset 9 (= RAM for dataset 4) of frequency inverter.

The frequency is to be set to 2000.00 Hz (non-permissible value). Parameter *Fixed frequency 3 482* has two decimal places. Thus the value to be sent is 20000 = 0x00030D40.

Request: Master → frequency inverter

Byte	...	0			1	2	3	4	5	6	7	8	9
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data			
	> 40 Bytes	7	6	5...0				LSB	MSB	long data			
		1	0	0	08	00	09	E2 01		40	0D	03	00

Error response: Frequency inverter → Master

Byte	...	0			1	2	3	4	5	6	7
	TCP/IP Header	Header			NoB	SYS	DS	P.-No.		data	
	> 40 Bytes	7	6	5...0				LSB	MSB	uint/int data	
		1	1	0	06	00	09	E2 01		01	00



For explanations of error codes, see 8.2 "Telegram check".

11 Control of frequency inverter

The frequency inverter can generally be controlled via three operation modes. The operation modes can be selected via the data set switchable parameter *Local/Remote 412*.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
412	<i>Local/Remote</i>	0	44	44

For operation with a Field bus, only operation modes 0, 1 and 2 are relevant. The other settings refer to the control option via the control unit.

Operation mode	Function
0 - Control via contacts (Chapter 11.1)	The Start and Stop commands as well as the direction of rotation are controlled via digital signals.
1 - Control via state machine (Chapters 11.2)	The frequency inverter is controlled via the control word.
2 - Control via remote contacts (Chapter 11.1)	The Start and Stop commands as well as the direction of rotation are controlled via virtual digital signals of the control word.



Parameter *Local/Remote 412* is dataset switchable, i.e. you can switch between the different operation modes by selecting another data set.

The data set switching can be effected locally via control contacts at the digital inputs of the frequency inverter or via the bus. For data set switching via the bus, parameter *Dataset selection 414* is used.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
414	<i>Data set selection</i>	0	4	0

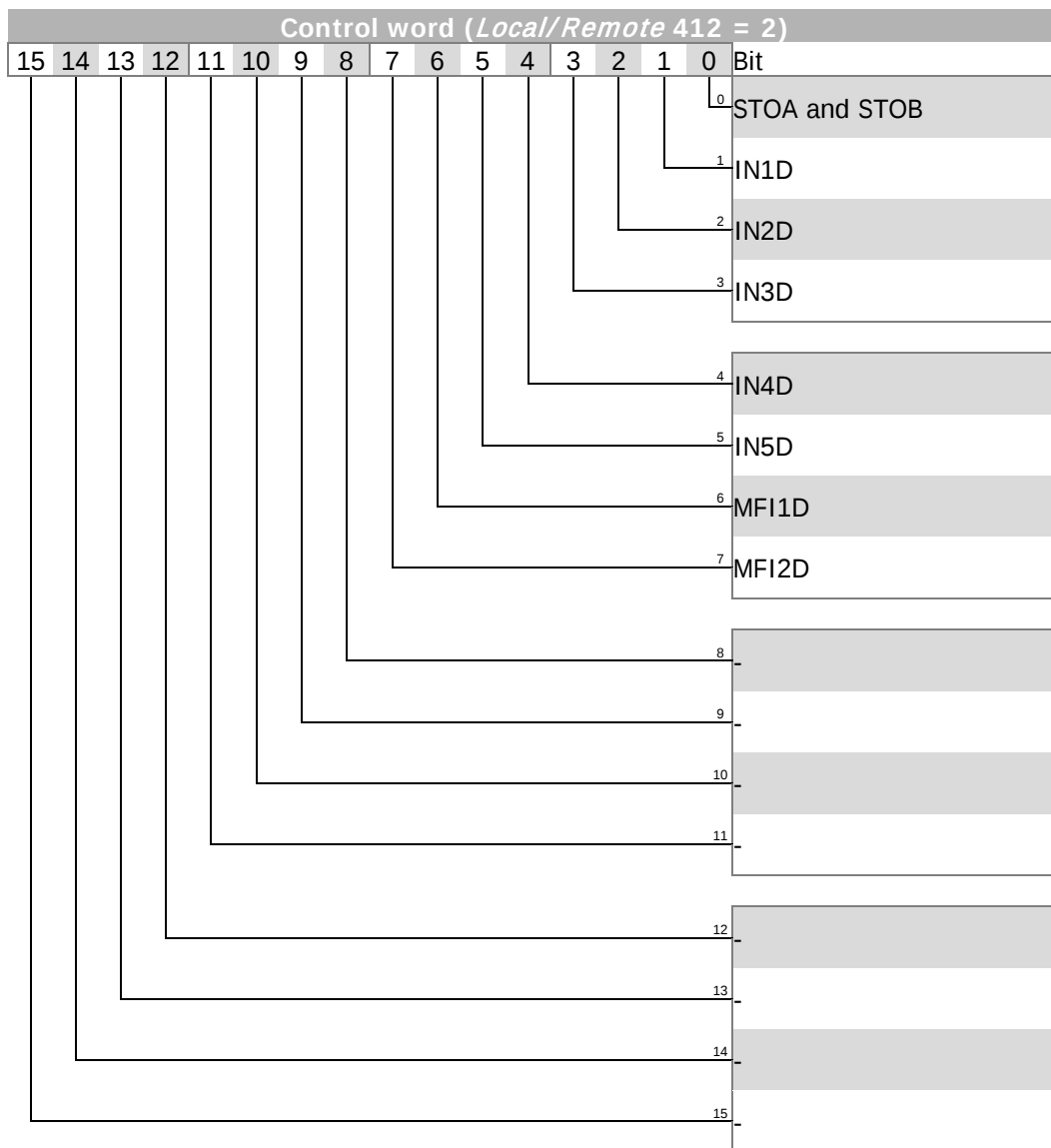
With *Data set selection 414* = 0, data set switching via contact inputs will be active. If *Data set selection 414* is set to 1, 2, 3 or 4, the selected data set is activated and data set switching via the contact inputs is deactivated.

If *Data set selection 414* is set to 5, data set switching via contact inputs will be active if the frequency inverter is not enabled.

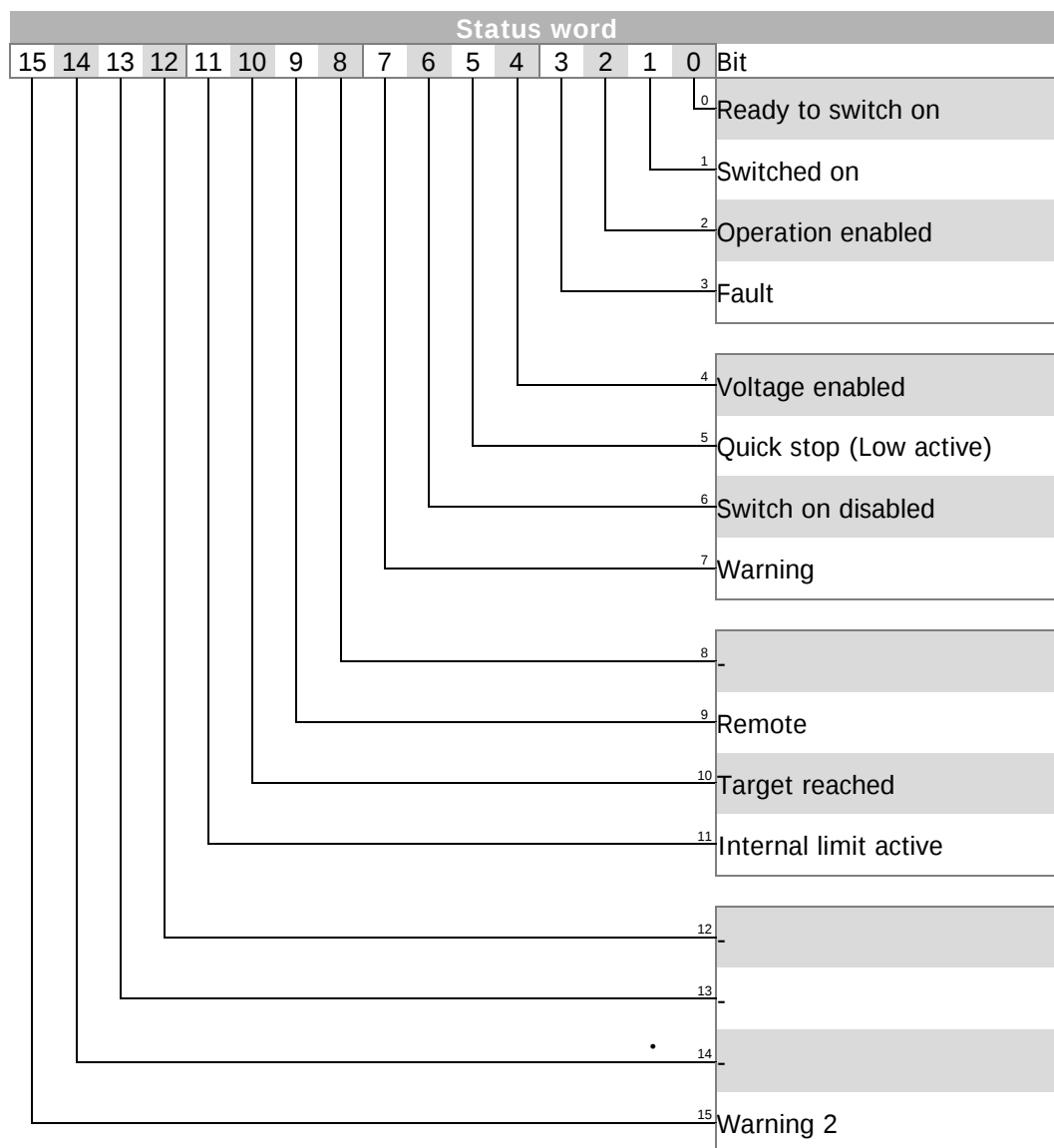
Via parameter *Active data set 249*, the currently selected data set can be read. *Active data set 249*, indicates the active data set (value 1, 2, 3 or 4). This is independent of whether the data set switching was done via contact inputs or *Data set selection 414*.

11.1 Control via contacts/remote contacts

In operation mode “Control via contacts” or “Control via remote contacts” (Parameter *Local/Remote* **412** = 0 or 2), the frequency inverter is controlled directly via digital inputs or via the individual bits of the virtual digital signals in the control word. The function of these inputs is described in the frequency inverter user manual.



The digital inputs set via the control word can be monitored using parameter *Digital Inputs* **250**. Digital input S1IND will only be displayed if controller release is switched on at STOA and STOB **and** the control word (Bit 0) was set. If the data set switching function is used, please ensure that Parameter *Local/Remote* **412** is set to “2 – Control via remote contacts” in all data sets used.



If operation mode “Control via remote contacts” is used, controller release must be turned on at STOA (Terminal X11.3) and STOB (Terminal X13.3) **and** Bit 0 of the control word must be set in order to be able to start the drive.



The frequency inverters support an external 24 V power supply for the frequency inverter control electronics. Even when mains voltage is disconnected, communication between the controller (PLC) and the frequency inverter is still possible.

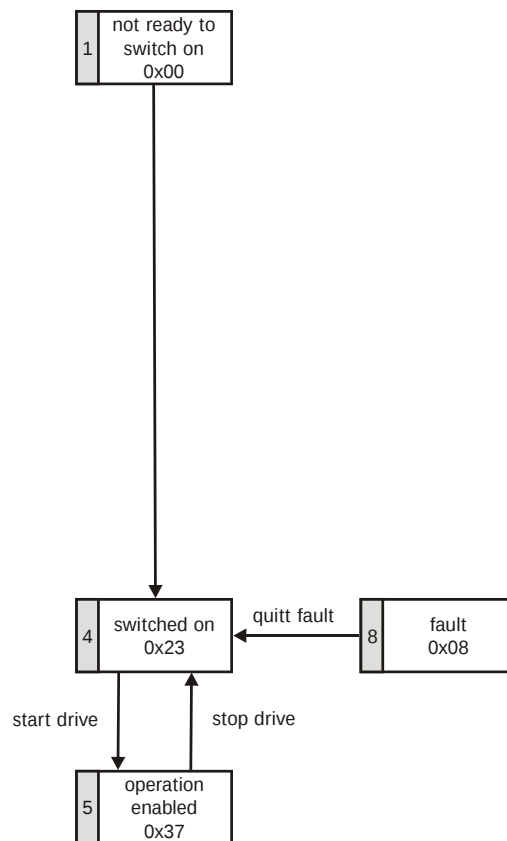
Bit 4 “Power supply – enabled” of the status word shows the current mains power supply status:

Bit 4 “Power supply – enabled” = **0** signals “No mains voltage”, starting of drive not possible.

Bit 4 “Power supply – enabled” = **1** signals “Mains voltage on”, drive ready for starting.

11.1.1 Device state machine

State machine:



Status word	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Switched on	1	0	0	0	1	1
Operation enabled	1	1	0	1	1	1
Fault	x	x	1	x	x	x



“x” means any value.

Bit 7 “**Warning**” can display a device-internal warning message at any time. The current warning is evaluated by reading the warning status with parameter *Warnings* **270**.

Bit 10 “**Target reached**” is set when the specified reference value is reached. In the special case of power failure regulation, the bit is also set when the power failure regulation reaches the frequency 0 Hz (see frequency inverter Operating Instructions). For “Target reached”, there is a hysteresis (tolerance range) which can be set via the parameter *Max. control deviation* **549** see frequency inverter operating instructions).

Bit 11 “**Internal limit value active**” indicates that an internal limit is active. This may be the current limit, the torque limit or the overvoltage control. All functions will result in the reference value being left or not reached.

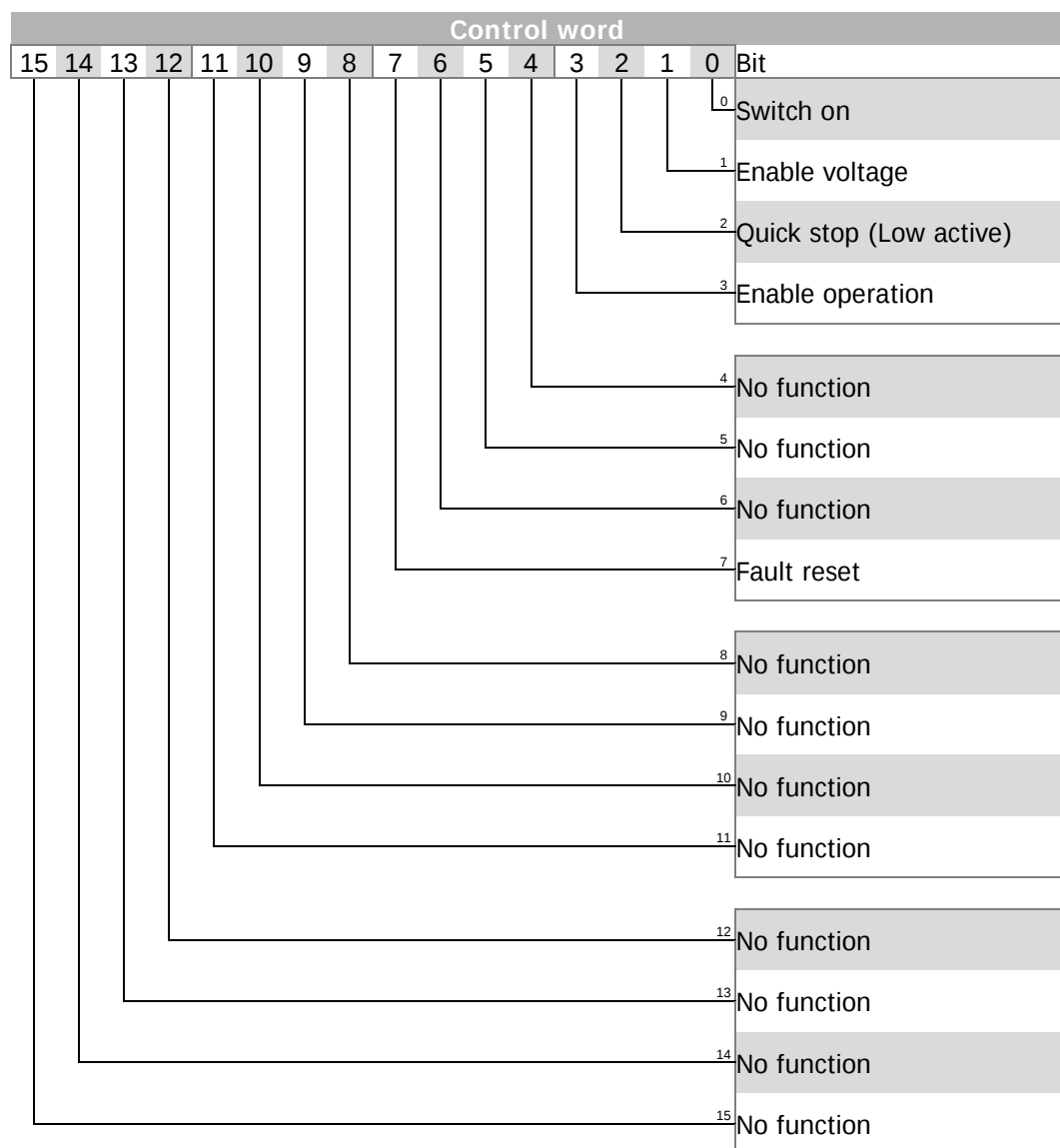
Bit 15 “**Warning 2**” signals a critical operating state which will result in a fault switch-off of the frequency inverter within a short time. This bit is set if there is a delayed warning relating to the motor temperature, heat sink/inside temperature, Ixt monitoring or mains phase failure.

11.2 Control via state machine

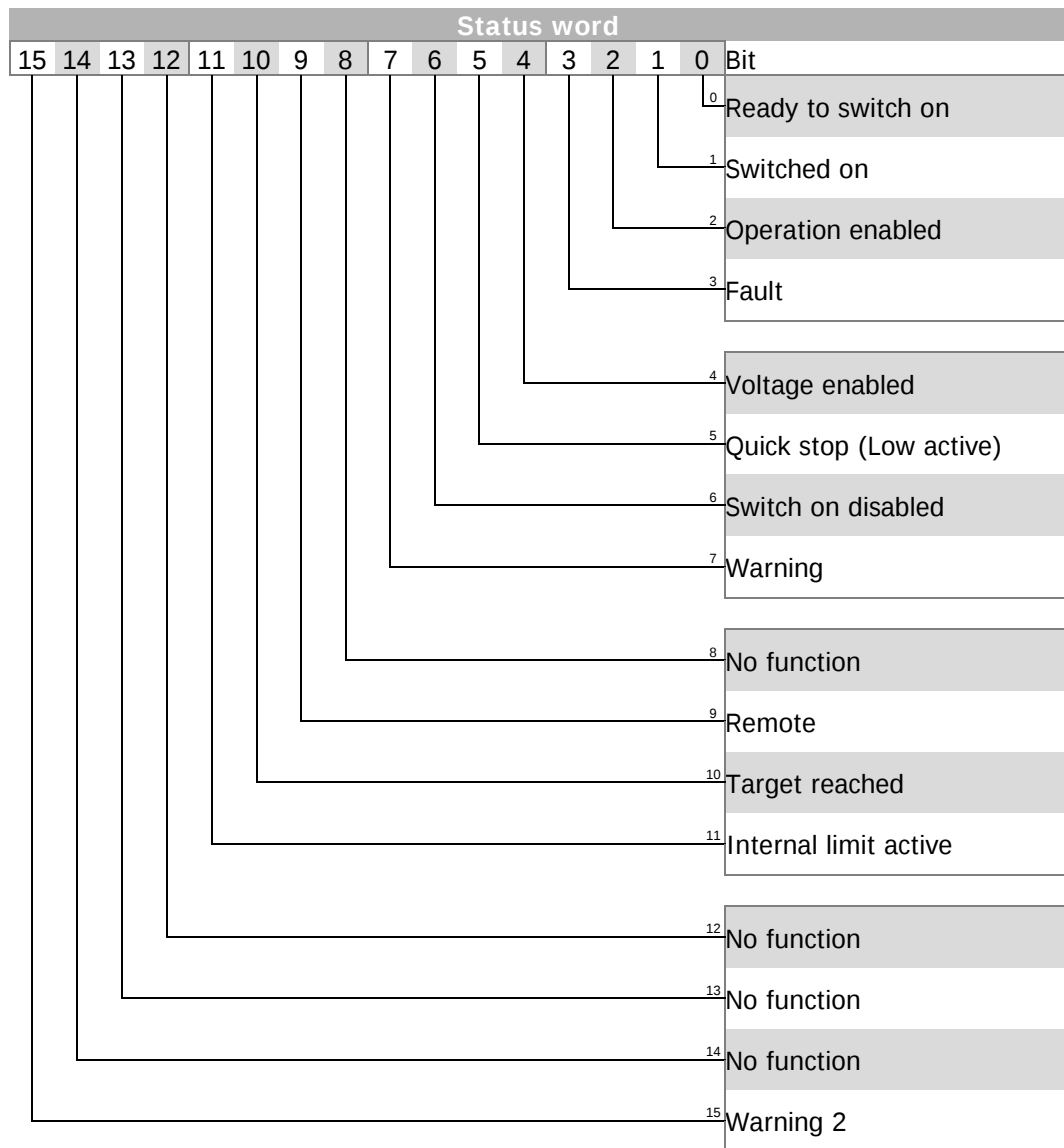
In this operation mode “Control via state machine” (*Local/Remote* **412** = 1), the frequency inverter is addressed via the control word of the state machine.

Transition 4 and 4' to status “Operation enabled” is only possible if the release (STOA and STOB) and Start Clockwise or Start Anticlockwise are set.

Parameter *Control word* **410** is applicable to the frequency inverter if parameter *Local/Remote* **412** is set to “1 – Control via statemachine.



The actual value parameter *Status word* **411** shows the current operating status.



Agile frequency inverters support an external 24 V power supply for the inverter control electronics. Even when mains voltage is disconnected, communication between the controller (PLC) and the frequency inverter is still possible.

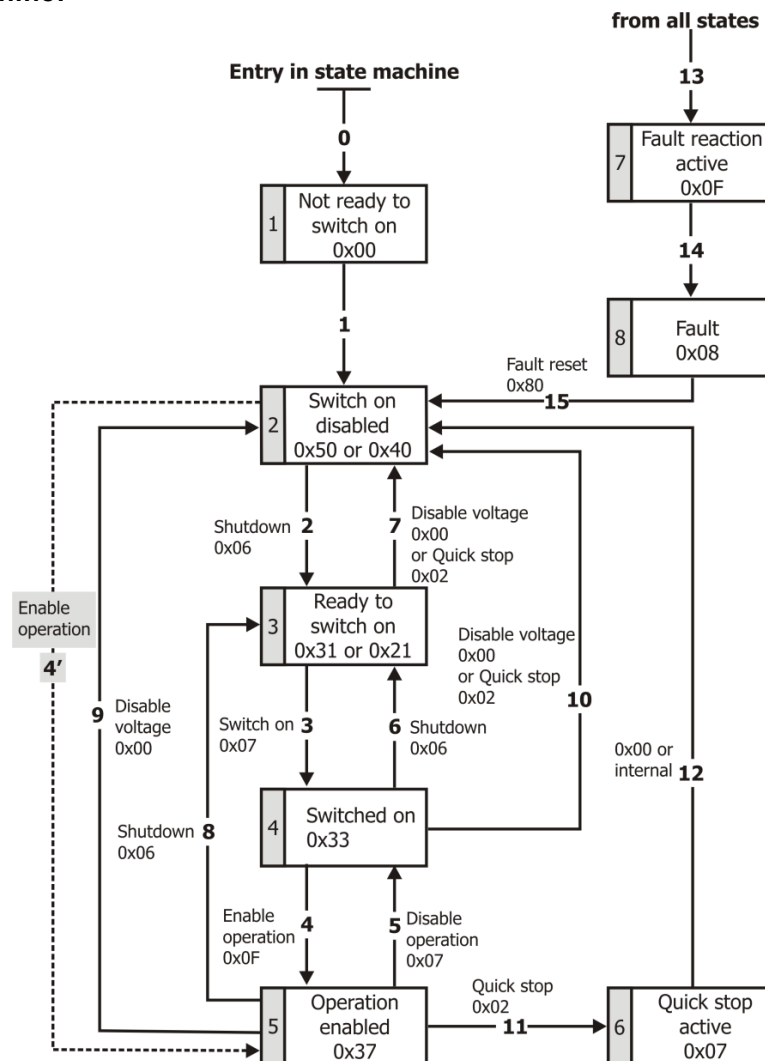
Bit 4 “Voltage enabled” of the status word shows the current mains power supply status:

Bit 4 “Voltage enabled” = **0** signals “No mains voltage”, starting of drive not possible.

Bit 4 “Voltage enabled” = **1** signals “Mains voltage on”, drive ready for start.

11.2.1 Statemachine diagram

State machine:



Control word:

The device control commands are triggered by the following bit patterns in the status word.

Control word						
Command	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	Transitions
	Fault reset	Enable operation	Quick stop (Low active)	Enable voltage	Switch on	
Shutdown	X	X	1	1	0	2, 6, 8
Switch on	X	0	1	1	1	3
Enable operation	X	1	1	1	1	4
Disable voltage	X	X	X	0	X	7, 9, 10, 12
Quick stop (Low active)	X	X	0	1	X	7, 10, 11
Disable operation	X	0	1	1	1	5
Fault reset	0 ⇒ 1	X	X	X	X	15

"X" means any value.



Transition 3 (command "Switch On" [0x07]) will only be processed if Bit 4 "Voltage enabled" of the Status word is set.



- Transition 4' will only be processed if Bit 4 "Voltage enabled" of the status word is set.
- The frequency inverter can only be controlled if the logic operation is true. The logic inputs for Start Clockwise and Start Anticlockwise can be connected directly with "On" or "Off" (parameter *Start clockwise* **68** and *Start anticlockwise* **69**). Digital inputs (STOA and STOB) must be set.
This results in:
Release: = (STOA and STOB) **AND** (Start clockwise **OR** Start anticlockwise)

Status word:

The status word indicates the operating status.

Status word						
State	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
	Switch on disabled	Quick stop (Low active)	Fault	Operation enabled	Switched on	Ready to switch on
Switch on disabled	1	X	0	0	0	0
Ready to switch on	0	1	0	0	0	1
Switched on	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1
Quick stop active	0	0	0	1	1	1
Fault reaction active	0	X	1	1	1	1
Fault	0	X	1	0	0	0



"X" means any value.

Bit 7 "**Warning**" can be set at any time. It reports a device-internal warning. The cause of the warning is evaluated by reading the warning status with parameter *Warnings* **270**.

Bit 9 "**Remote**" is set if the operation mode is set to "Control via state machine" (*Local/Remote* **412** = 1) **and** controller release is turned on.

Bit 10 "**Target reached**" is set when the specified reference value is reached.
In the special case of power failure regulation, the bit is also set when the power failure regulation reaches the frequency 0 Hz (see frequency inverter operating instructions).
For "Target reached", there is a hysteresis (tolerance range) which can be set via the parameter *Max. control deviation* **549** see frequency inverter Operating Instructions).

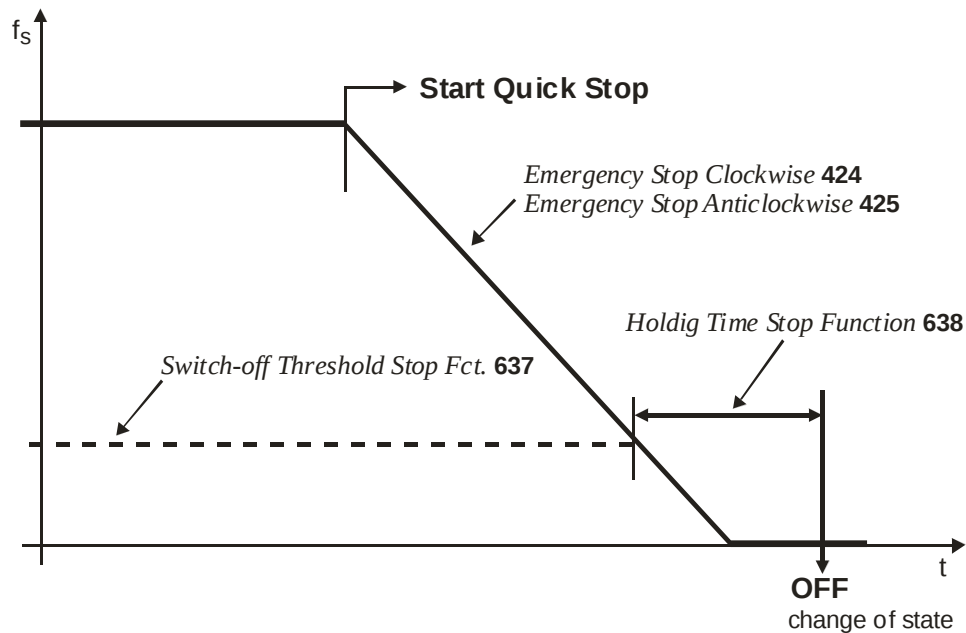
Bit 11 "**Internal limit value active**" indicates that an internal limit is active. This may be the current limit, the torque limit or the overvoltage control. All functions will result in the reference value being left or not reached.

Bit 15 "**Warning 2**" signals a critical operating state which will result in a fault switch-off of the frequency inverter within a short time. This bit is set if there is a delayed warning relating to the motor temperature, heat sink/inside temperature, Ixt monitoring or mains phase failure.

11.3 Behavior in the case of a quick stop

In quick stop, the parameters *Switch-Off Threshold* **637** (percent of parameter *Maximum Frequency* **419**) and *Holding time* **638** (holding time after falling short of the Switch-Off Threshold) are relevant. *Maximum Frequency*. In the case of a quick stop, the drive is stopped via emergency stop ramps.

The emergency stop ramps are set via parameters *Emergency Stop Clockwise* **424** and *Emergency Stop Anticlockwise* **425**.



If frequency/speed reaches the value zero during the switch-off time, the drive continues to be supplied with current until the switch-off time has elapsed. This ensures that the drive is at a standstill when the state changes.

11.3.1 Behavior in the case of transition 5 (disable operation)

The behavior in transition 5 from “Operation enabled” to “Switched On” can be configured via parameter *State transition 5* **392**.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
392	State transition 5	0	2	2

Operation mode	Function
0 -Coast to stop	Immediate transition from “Operation enabled” to “Switched On”, drive coasts to a standstill
1 -DC brake	Activation of DC brake, at the end of DC deceleration, there is the change from “Operation enabled” to “Switched On”
2 -Ramp	Transition with normal ramp, when the drive has come to a standstill, there is the change from “Operation enabled” to “Switched On”



Setting 1 “Direct current brake” is only possible with applications with U/f characteristic control (e.g. configuration 110). Other configurations do not support this operation mode.

If the frequency inverter is operated with a configuration which does not support the operation mode Direct Current Brake (e.g. configuration 210, field-oriented control), value “1” cannot be used.

In this case, the operation mode is not offered in the selection menus of the control unit KP500 and the control software VPlus.



By default, *State-transition 5* **392** is set to operation mode “2 - Ramp” For configurations with torque control, the default value is “0 - coasting”.

If the configuration is changed, the value set for *State-transition 5* **392** is also changed, if necessary.



The behavior in transition 5 is only relevant for configurations without Motion Control (parameter *Configuration* **30** ≠ x40).

If *State-transition 5* **392** was triggered with “1 - DC brake”, a new control word will only be accepted after completion of the transition process. The change of state from “Operation enabled” to “Started” is done after the *Braking time* **632** parameterized for the DC brake has elapsed.

If parameter *State-transition 5* **392** = “2 - Ramp” is set, the control word can be set to “Operation enabled” again, while the drive is decelerating. In this way, the drive accelerates to its set reference value again and remains in the state “operation enabled”.

The change of state from “Operation enabled” to “Switched On” is done after the value has dropped below the set Switch-Off Threshold and the set holding time has elapsed (equivalent to the behavior in the case of a quick stop). In this context, parameters *Switch-Off Threshold stop function* **637** (percentage of parameter *Maximum Frequency* **419**) and *Holding time* **638** (Holding time after passing of threshold) are relevant.

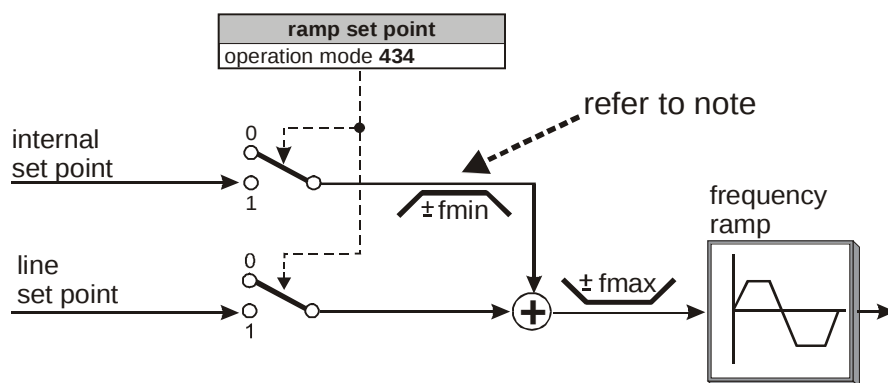
11.3.2 Reference value / actual value

The controller (PLC) can define the reference frequency for the frequency inverter via parameter *Reference frequency RAM [Hz]* **484** and receive the actual value via parameter *Actual speed* **240**.

In the reference frequency channel, via parameter *Reference frequency source 1* **475** or *Reference frequency source 2* **492**, you can select setting “20 – Field bus reference value”.

Actual values		
Parameters	Contents	Format
<i>Internal reference frequency</i> 228	Internal reference value from the reference frequency channel	xxx.xx Hz
<i>Bus reference frequency</i> 282	Reference line value from Field bus	xxx.xx Hz
<i>Ramp reference frequency</i> 283	= sum of internal reference frequency + reference line value	xxx.xx Hz

The reference value for the frequency inverter from parameter *Reference frequency RAM [Hz]* **484** is connected to the reference line value. This reference value will be combined with the internal reference value from the reference frequency channel and directed to the ramp. For information on the reference frequency channel, refer to the operating instructions of the frequency inverter.



The internal reference value from the reference frequency channel and the reference line value can be led to the ramp individually or as an added variable. The operation mode of the ramp function is set via the data set switchable parameter *Reference ramp* **434**.

Reference percentage **524** can be used for regular changing of reference percentages, e.g. as a reference value for technology controllers or as a reference torque.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
434	Ramp Setpoint	1	3	3
484	Reference frequency RAM [Hz]	-999.99	999.99	0.00
524	Reference percentage RAM [%]	-300.00	300.00	0.00

Operation mode 434		Function
1	- Internal reference frequency	The internal reference frequency is determined from the reference frequency channel.
2	- Reference line value	The reference value is supplied externally via the bus
3	- Internal reference frequency + reference line value	Addition (considering the sign) of internal reference frequency and reference line value

11.3.3 Example sequence

1	Control word =	0x0000	Disable voltage
2	Control word =	0x0006	Shut down
3	Control word =	0x0007	Switch On
4	Control word =	0x000F	Enable operation

OR

1	Control word =	0x0000	Disable voltage
2	Control word =	0x000F	Enable operation

12 Actual values

Actual values		
No.	Description	Function
11	VABus SST error register	Modbus or VABus error register. See chapter 8.2 "Telegram check".
282	Bus reference frequency	Reference value from serial interface.
283	Ramp reference frequency	Reference value from reference frequency channel.
411	Status word	Status word. See chapter 11.1 "Control via contacts/remote contacts".

13 Parameter List

The parameter list is sorted numerically. For better overview, the parameters are marked with pictograms:

-  The parameter is available in the four data sets.
-  The parameter value is set by the SET-UP routine
-  This parameter cannot be written when the frequency inverter is in operation.

13.1 Actual values (Menu “Actual”)

Actual value parameter				
No.	Description	Unit	Indication range	Chapter
RS485 / RS232				
11	VABusSST-Error-Register	-	0 ... 15	8.2
Actual values of frequency inverter				
228	Internal reference frequency	Hz	-1000,00 ... 1000.00	11.3.2
240	Actual speed	min ⁻¹	-60000 ... 60000	11.3.2
249	Active dataset	-	0 ... 4	11
260	Current error	-	0 ... 0xFFFF	14.5
270	Warnings	-	0 ... 0xFFFF	14.3
274	Warning application	-	0 ... 0xFFFF	14.4
282	Bus reference frequency	Hz	-999,99 ... 999,99	12
283	Ramp reference frequency	Hz	-999.99 ... 999.99	
Bus control				
411	Status word	-	0 ... 0xFFFF	11.2
VABus / TCP				
1431	Module Info	-	String	7.4.2.1



Parameters *Current error 260*, *Warnings 270* and *Application warnings 274* are only accessible via Field Bus. They cannot be addressed via the VPlus control software or the control unit.

13.2 Parameters (Menu “Para”)

Parameters				
No.	Description	Unit	Setting range	Chapter
VABus / TCP				
388	Bus Error Behaviour	-	0 ... 5	7.5
Bus control				
392	State Transition 5	-	Selection	11.3.1
410	Control word	-	0 ... 0xFFFF	11.2
412	Local/Remote	-	Selection	11
Data set switching				
414	Data set selection	-	0 ... 4	11
Frequency ramps				
434	Ramp Setpoint	-	Selection	11.3.2
Fixed frequency values				
484	Reference frequency RAM	Hz	-999.99 ... 999.99	11.3.2
Fixed percentages				
524	Reference percentage RAM	%	-300,00 ... 300.00	11.3.2
Digital outputs				
549	Max. control deviation	%	0.01 ... 20.00	11
Stopping behavior				
637	Switch-Off Threshold	%	0.0 ... 100.0	11.3, 11.3.1
638	Holding Time	s	0.0 ... 200.0	
System Bus				
900	Node-ID	-	Selection	8.1.4
VABus / TCP				
1432	IP address	-	-	7.2
1433	Netmask	-	-	
1434	Gateway	-	-	
1435	DNS Server	-	-	
1436	DHCP Option	-	Selection	
1437	IP command	-	Selection	
1440	Email Function	-	Selection	
1441	Email Text (Body)	-	Text	

14 Appendix

14.1 List of control words

The tables on this page provide an overview of the functions of the **control word** bits.

Bit	<i>Standard (no positioning)</i>
0	Switch On
1	Enable Voltage
2	Quick Stop (low active)
3	Enable Operation
4	
5	
6	
7	Fault reset
8	Halt
9	
10	
11	
12	
13	
14	
15	

14.2 List of status words

The tables on this page provide an overview of the functions of the status word bits.

Bit	<i>Standard (no positioning)</i>
0	Ready to Switch On
1	Switched On
2	Operation enabled
3	Fault
4	Voltage enabled
5	Quick Stop (low active)
6	Switch On Disabled
7	Warning
8	
9	Remote
10	Target reached
11	Internal limit active
12	
13	
14	
15	Warning 2

14.3 Warning messages

The different control methods and the hardware of the frequency inverter include functions for continuous monitoring of the application. In addition to the messages documented in the frequency inverter user manual, further warning messages are activated by the Field Bus module. The bit-coded warning reports are issued via parameter *Warnings 270* according to the following pattern: Parameter *Warnings 270* is provided for read-out via a PLC, Parameter *Warnings 269* provides the information, including a brief description in VPlus and the control panel.

Warning messages		
Bit no.	Warning code	Description
0	0x0001	Warning lxt
1	0x0002	Warning short-time lxt
2	0x0004	Warning long-time lxt
3	0x0008	Warning heat sink temperature Tk
4	0x0010	Warning inside temperature Ti
5	0x0020	Warning Limit
6	0x0040	Warning Init
7	0x0080	Motor temperature warning
8	0x0100	Warning mains failure
9	0x0200	Warning motor circuit breaker
10	0x0400	Warning Fmax
11	0x0800	Warning analog input MFI1A
12	0x1000	Warning analog input A2
13	0x2000	Warning System Bus
14	0x4000	Warning Udc
15	0x8000	Warning <i>Application warning status 273</i>



The meanings of the individual warnings are described in detail in the frequency inverter Operating Instructions.

14.4 Application warning messages

When the highest bit of the warning message is set, an “Application warning message” is present. The application warning messages are bit-encoded as per the following pattern via parameter *Application warnings 274*. Parameter *Application warnings 273* indicates the warnings as plain text in the control panel and the VPlus PC control software.

Use parameter *Application warnings 274* in order to read the warning messages via Field Bus.

Application warning messages			
Bit no.	Warning code	Description	
0	0x0001	BELT	- V-belt
1	0x0002	(reserved)	
2	0x0004	(reserved)	
3	0x0008	(reserved)	
4	0x0010	(reserved)	
5	0x0020	(reserved)	
6	0x0040	SERVICE	– Service Warning
7	0x0080	User 1	– User Warning 1
8	0x0100	User 2	– User Warning 2
9	0x0200	(reserved)	
10	0x0400	(reserved)	
11	0x0800	(reserved)	
12	0x1000	(reserved)	
13	0x2000	(reserved)	
14	0x4000	(reserved)	
15	0x8000	(reserved)	



For details on the warnings, refer to the frequency inverter Operating Instructions.

14.5 Error messages

The error code stored following a fault comprises the error group FXX (high-byte, hexadecimal) and the code YY (low-byte, hexadecimal).

Communication error		
Key		Meaning
Ethernet	F27 14	Communication loss to PLC

The current error can be read via parameter *Current error* **260**.

Parameter *Current error* **259** indicates the current error as plain text in the control panel and the VPlus PC control software.

In addition to the errors listed, there are other error messages. However, they are used for internal purposes only and are not listed here. If you come across fault messages which are not listed here, please do not hesitate to call us.

14.6 Conversions

The speeds/frequencies can be converted to other speed formats using the formulas in this chapter:

Speed [1/min] in	Frequency [Hz]	See Chapter 14.6.1
Frequency [Hz] into	speed [1/min]	See Chapter 14.6.2

14.6.1 Speed [1/min] into frequency [Hz]

$$f [\text{Hz}] = \frac{n[\text{min}^{-1}] \times \text{No. of pole pairs (P.373)}}{60}$$

14.6.2 Frequency [Hz] into speed [1/min]

$$n[\text{rpm}] = \frac{f [\text{Hz}] \times 60}{\text{No. of pole pairs (P.373)}}$$

14.7 ASCII table (0x00 – 0x7F)

Dec.	Hex.	Char.
0	00	NUL
1	01	
2	02	STX
3	03	ETX
4	04	EOT
5	05	ENQ
6	06	ACK
7	07	BEL
8	08	BS
9	09	TAB
10	0A	LF
11	0B	VT
12	0C	FF
13	0D	CR
14	0E	
15	0F	
16	10	
17	11	
18	12	
19	13	
20	14	
21	15	NAK
22	16	
23	17	
24	18	
25	19	
26	1A	
27	1B	ESC
28	1C	
29	1D	
30	1E	
31	1F	
32	20	SPACE
33	21	!
34	22	„
35	23	#
36	24	\$
37	25	%
38	26	&
39	27	'
40	28	(
41	29	)
42	2A	*

Dec.	Hex.	Char.
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?
64	40	@
65	41	A
66	42	W
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	D
85	55	U

Dec.	Hex.	Char.
86	56	V
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	]
94	5E	^
95	5F	_
96	60	`
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	
125	7D	}
126	7E	~
127	7F	DEL



Frequently used values are marked.

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