Bonfiglioli

Vectron

Agile

PROFINET
Communication module CM-PROFINET
Frequency inverter 230 V / 400 V

Bonfiglioli
power, control and green solutions

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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

The present user manual of the CM-PROFINET communication module complements the Operating Instructions and the "Quick Start Guide" for the frequency inverters of the Agile device series.

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

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

> ⚠ **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 by 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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Germany

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 case 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 qualifications 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 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 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.

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
ℹ	Tips and information making using the frequency inverter easier.

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 neighbouring 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.

3   Introduction

The present document describes the possibilities and properties of the PROFINET communication module CM-PROFINET for the frequency inverters of the *Agile* series of devices.

Specification: PROFINET IO device, real-time class 1, conformance class A.

For a PROFINET connection, the frequency inverter must be equipped with the CM-PROFINET communication module. The CM-PROFINET component is supplied separately and must be installed separately. The installation procedure is described in Chapter 6.1 "Assembly".

This manual is not to be understood as providing general/basic information on PROFINET It requires basic knowledge of the methods and effects of PROFINET on the user's side.

In some chapters, setting and display options via the PC software VPlus are described as an alternative to the control panel. If you wish to use the VPlus PC software, you will need an optional serial interface or direct Ethernet connection to the PROFINET system.
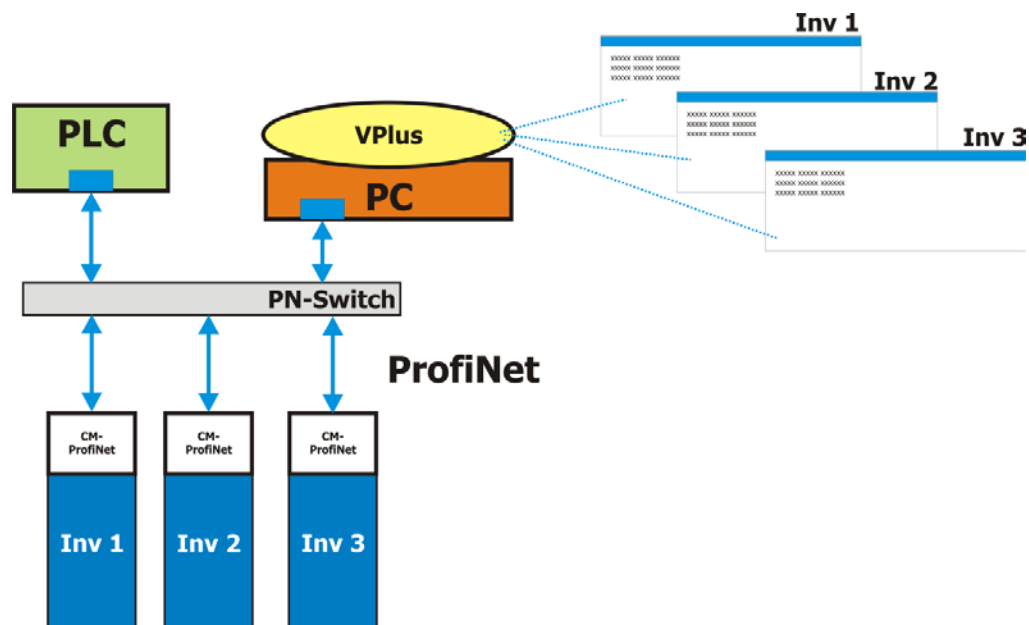
The PROFINET component CM-PROFINET has manufacturer ID 0x020B (hexadecimal).

The latest device description can be downloaded from the Bonfiglioli.com website. The file bears a name like **GSDML-V2.3-BV-CMM-20130604.xml**, where the version number and the date might be updated.

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

With the CM-PROFINET communication module, it is possible to access **ALL** frequency inverter parameters from a controller. In this case, there is no access control via the control panel or the VPlus PC control software. Changing parameters, the functions of which are not known to the user, can result in unintended movements and material and/or personal losses as well as inoperativeness of the frequency inverter.

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.
          ▪ Target velocity.
      o Reference percentage for technology controller or torque control
          ▪ Analog input.
          ▪ Fixed values from parameters.

See Chapter "10 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.
          ▪ Target velocity.
      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 the module   Chapter 6.1
- Selection of device control *Local/Remote* **412**   Chapter 10
- Commissioning of device functions via PLC
    - o   Setting the station address   Chapter 7.3
    - o   Setting the process data   Chapter 8
    - o   Fault Reaction   Chapter 7.5
        - ▪   Resetting errors   Chapter 9.5
    - o   Parameter access   Chapter 9.1
- Setting reference values:
    - o   Reference speed   Chapter 10.2.4
- Diagnosis: Chapter 10, 11

5 Communication options

Slot for optional Communcation Module

CM-232	RS232 VABus or Modbus
CM-485	RS485 VABus or Modbus
CM-PDPV1	Profibus DP-V1
CM-CAN	Systembus or CANopen

Control Terminals — X12

CAN H / CAN L — 5 6
1 2 3 4 5 6
Systembus or CANopen protocol

X21 Communcation Interface with RJ45-Connection:

- VABus or Modbus
- USB Connection of a PC with optional Adapter.
  PC with Vplus Software for Parameterization and Monitoring.

Interface	See
CAN connection control terminals	Instructions on System Bus or CANopen$^®$.
CM-CAN	
Communication interface X21	Instructions on VABus or Modbus
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 System Bus and CANopen$^®$ communication at the two interfaces:

Optional communi-cation module (CM)		Frequency inverter terminals X12.5 and X12.6
CANopen$^®$	and (at the same time)	System Bus
System Bus	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.
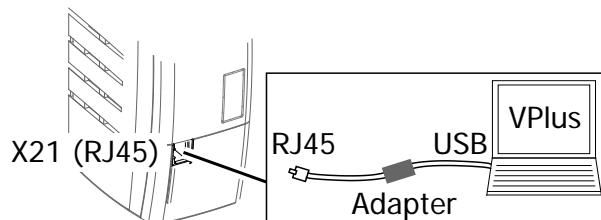
6 Assembly/disassembly of the communication module

6.1 Assembly

The CM-PROFINET communication module is delivered in a case for assembly. 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.
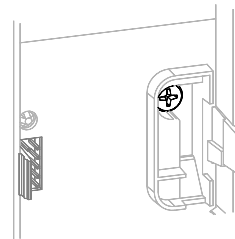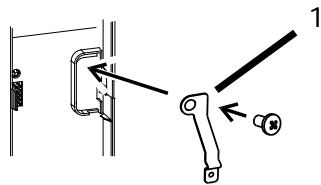
- Insert the communication module.
- Fix the communication module (2) at the frequency inverter using the screw (3).
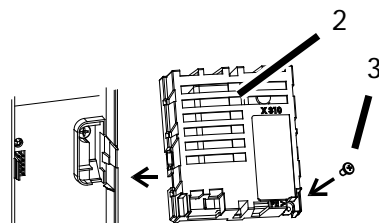
- Break out the pre-punched cut-out from the cover.
- Fix the cover again.

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) on the communication module.
- Using a small screwdriver, unlock the hooks (4) (first right then left).
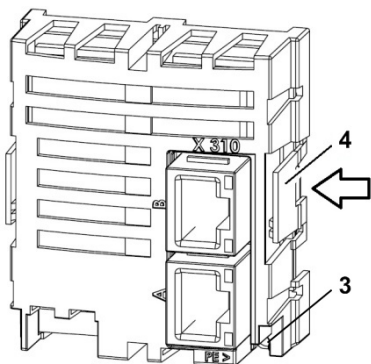
- Pull communication module out of slot.
- Unscrew PE-spring.
- Fix the cover on the frequency inverter.

7 Description of module and commissioning

7.1 Connector assignment

The CM-PROFINET module is connected to the PLC or switch using RJ45 connectors (LAN).
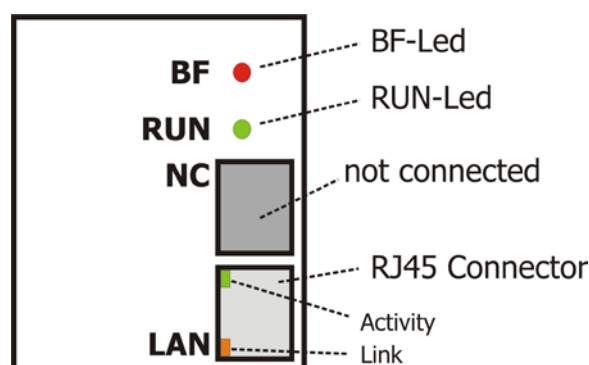
7.2 LED state indicators

The green RUN LED indicates the current state of the module

RUN-LED state	Module state
Off	Module is off.
On	Module is on and running.

The red BF-LED (bus failure LED) indicates the current status of the connection.

BF-LED state	Link communication state
On	Module has no Ethernet connection.
Flashing	Module has Ethernet link, no exchange of cyclic data.
Off	Exchange of Cyclic data is taking place.

7.3 Setting the station address

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

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

In the case of replacement of a module, a special function of the CM-PROFINET module enables assignment of a device name without the PROFINET configurator.

The TCP/IP configuration of VPlus shows the IP settings and, as the "Host name", the device name saved in the module.

If a CM-PROFINET module must be replaced, the device name assigned before **without** PROFINET configurator can be assigned again.

- Start the TCP-IP configuration in VPlus and enter the device name as the "Host name".

The IP settings must also be made again.

7.4   Alarm messages

In the case of a frequency inverter fault, CM-PROFINET sends an alarm message. This function can be deactivated via Parameter *Profibus/PROFINET Diagnostic/Alarm Message* **1444**.

Diagnostic/Alarm Message 1444	Function
0 - Off	No alarm message in the case of a frequency inverter fault.
1 - On	Alarm message in the case of a frequency inverter fault. **Factory setting.**

List of Alarm messages

Error Type	Error Text	Help Text
257	Ixt Overload	F01nn Inverter rated current exceeded
258	Heatsink temperature	F02nn Heatsink temperature too high
259	Inside temperature	F03nn Inside temperature too high
260	Motor connection	F04nn Motor temperature, protection switch, V-belt monitoring, phase failure
261	Output current	F05nn Overload, short circuit, earth fault, asymmetric current, phase monitoring
262	Power stage detection	F06nn Power stage detection incorrect
263	DC-Link voltage	F07nn DC-Link voltage too low/high, brake/motor chopper threshold too small
264	Electronic voltage	F08nn Electronic voltage DC 24V too low/high
265	Pre-charging relay	F09nn Pre-charging relay faulted
272	Brake chopper	F10nn Brake chopper faulted
273	Output frequency	F11nn Output frequency exceeded maximum frequency
274	Safety function STO	F12nn Diagnosis error of function STO, STOA/STOB monitoring
275	Motor load	F13nn Earth fault, IDC compensation limit, minimum current monitoring
276	Control connection	F14nn Encoder signals, external error
277	Table travel record	F15nn Table travel record, error in motion blocks
278	Parameter	F16nn Parameter error
279	Encoder	F17nn Encoder error
289	CAN-Systembus slave error	F21nn CAN-Systembus slave node id = nn reports error
290	CAN-Systembus	F22nn CAN-Systembus error
292	EM-Module	F24nn Unknown EM-Module
304	Application	F30nn Application error
511	Generic	Fxxxx Generic error

7.5 Operating behavior in the case of bus connection failure

The operating behavior in the case of failure of the PROFINET systems can be parameterized. The required behavior can be set via parameter *Bus Error behavior* **388**.

Bus Error behavior 388	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 d" 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**.

There are numerous options of parameterizing the fault and warning behavior of the frequency inverter. For details about possible faults, refer to Chapter 12.5 "Error messages".

8 Setting the process data

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

Two types of process data objects are available:

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

Process data objects		
Object	Object length / bytes	Object length / words
PKW	8	4
PZD	4	2

For more information on the contents of the objects, refer to Chapter 9 "Handling of objects".

The PKW object is used for read and write access to frequency inverter parameters. The object will produce additional bus load because it will send its contents with each data exchange cycle, no matter if it is actually needed or not. As an alternative to the PKW object, the CM-PROFINET module supports read and write access to data sets. The function is described in Chapter 9.2 "Parameter access through reading/writing of data sets".

Each PZD object contains two Word data type input and output objects. For information on how to handle this object, refer to Chapter 9.3.1 "Data types of OUT/IN objects".

8.1   Configuration process on PROFINET IO controller

The following chapter describes the configuration procedure of a frequency inverter with the PROFINET communication module CM-PROFINET using the example of the Siemens STEP7 hardware configurator. Generally, the procedure is the same for other configurations.

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

Once the GSD file is installed, the frequency inverter will appear on level:

PROFINET IO\ Additional Field Devices \Drives\Bonfiglioli Vectron\ PROFINET IO Connection

From this position, a frequency inverter **BV Drive** can be connected to the PROFINET system (drag & drop).
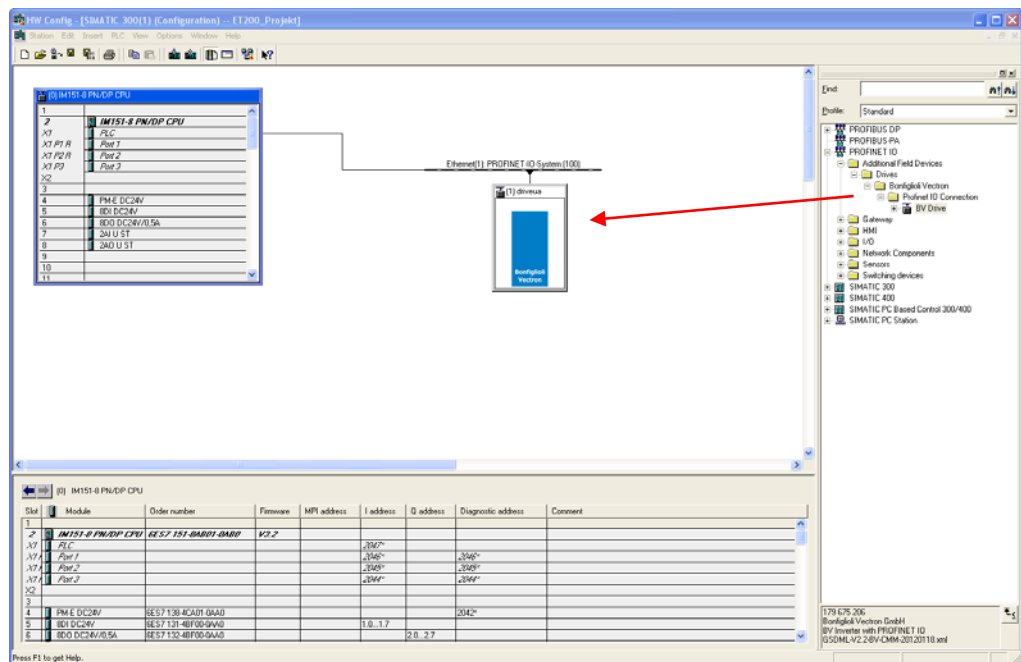
The two possible objects PKW and PZD are available in the **BV Drive** menu. The required object can be assigned to the frequency inverter (drag & drop).

The screen shot of the STEP7 hardware configurator shows a frequency inverter configured with 3 PZD objects connected to the PROFINET IO system.
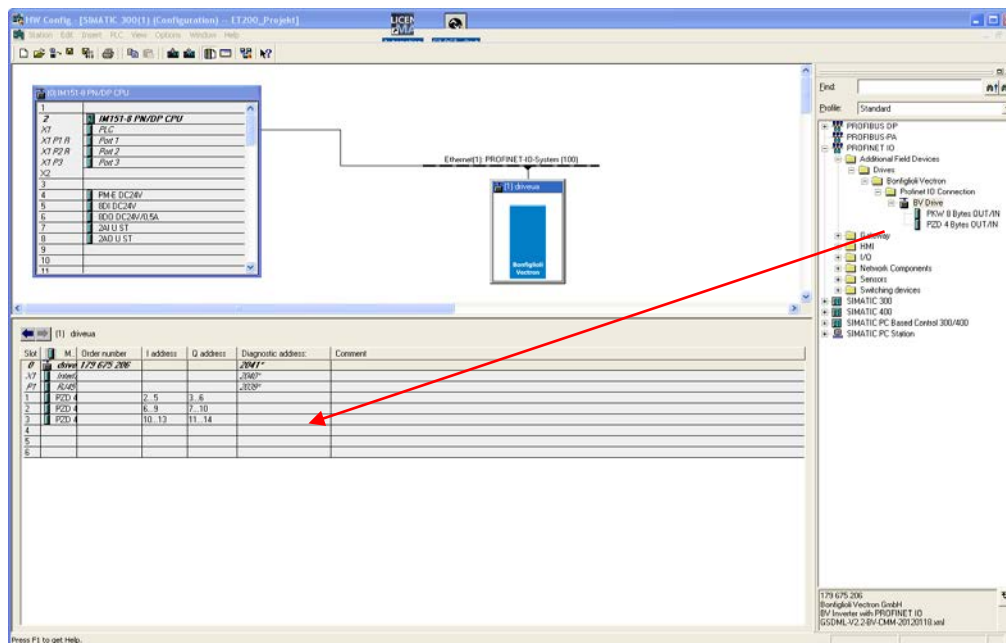
- The data flow direction IN/input and OUT/output is given from the PLC's point of view.
- Each configured PZD object comprises two word objects (4 bytes) PZDn and PZDn+1, one for input and one for output.

Restrictions for user-defined configuration settings:
- The PKW object is allowed only once at slot 1.
- At least one PZD object must be configured.
  - The total number of bytes must be less than or equal to 24 bytes (12 words).
-

> If the restrictions are not followed, a configuration error is signalled by the controller (PLC) upon PROFINET startup.

8.2   Available objects

The configured data exchange objects generally have two components which are available either fully, partly or not at all in the different object configurations. These components are the communication channel and the process channel.

The **communication channel** (PKW object) is used for access (write/read) to any parameters in the frequency inverter. The string parameters to which no access is possible form an exception. The communication follows a defined handshake procedure and includes several cyclic data exchange cycles.

The **process data channel** (PZD object) is processed in each cycle. Reference values are taken over and actual values are handed over. Thus, the data is updated with each cyclic data exchange.

Transmission direction IO controller ➔ IO device (OUT)

Communication channel				Process data channel					
PKW range				PZD range					
PKE	IND	PWE	PWE	PZD 1	PZD 2	PZD x	PZD x	PZD x	PZD x
		PWEh	PWEl	STW	HSW	Outx	Outx	Outx	Outx

PKW   Parameter ID Value
PZD   Process data channel   STW = Control   HSW = Main reference
                                      word   value

Outx = User defined

Transmission direction IO device ➔ IO controller (IN)

Communication channel				Process data channel					
PKW range				PZD range					
PKE	IND	PWE	PWE	PZD 1	PZD 2	PZD x	PZD x	PZD x	PZD x
		PWEh	PWEl	ZSW	HIW	Inx	Inx	Inx	Inx

PKW   Parameter ID Value
PZD   Process data channel   ZSW = Status word   HIW = Main actual
                                                           value

Inx = User defined

Process data channel objects PZD1/PZD2 are fixed and cannot be edited. This definition also applies to user-defined configurations.

The contents of process data channels PZD3 through PZD12 (maximum, without communication channel PKW) are user-defined.

> In the data transmission, it is assumed that the **Motorola format** is used as supported by a PLC type Siemens S7.

9 Handling of objects

9.1 Parameter access via communication channel PKW

The communication channel (PKW range) has the following structure:

Designa-tion	PKW range							
	PKE		IND		PWE-high		PWE-low	
Contents	Parameter ID		Index		Parameter value high word		Parameter value low word	
	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
			Data set	Sys-tembus				
Byte no.	0	1	2	3	4	5	6	7

The data is transmitted in the **Motorola format** as used by the S7 PLC from Siemens, for example. Thus, the high byte is on the lower byte of the message, and the low byte is on the higher byte.

> The data set is always on the high byte of "Index" (data set/byte no. 2). If system bus is used, a system bus address is set on the low byte of "Index" (Systembus/byte no. 3). With this parameter, access to a Systembus client is possible. See Systembus instructions.

Structure of parameter ID (PKE):															
PKE	High byte								Low byte						
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	AK				0				PNU							

AK: Order / response ID (value range 0 ... 15)
PNU: Parameter number (value range 1 ... 1599)

The order and response IDs are stored in the AK range. If no parameter processing is to be performed, the function type **"No Order"** must be selected.

The PNU range transmits the number of the parameter to be edited.

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

> An Excel file containing the required information about the parameters as regards the data type and data set switchability can be made available upon request.

9.1.1 Order ID

Structure of order ID AK (in output data set, Master ➔ Slave)		
Order ID AK	**Data type**	**Function**
0	-	**no order**
1	int/uint , long	read parameter value
2	int/uint	write int/uint parameter value
3	long	write long parameter value
6	int/uint , long array	read array parameter value
7	int/uint array	write int/uint array parameter value
8	long array	write long array parameter value

Array: Applies to data set switchable parameters. In Data set/INDEX, you will have to specify the required data set, otherwise Data set/INDEX = 0.

9.1.2 Response ID

Structure of response ID AK (in input data set, Slave➔ Master)		
Response ID	**Data type**	**Function**
0	-	**no order**
1	int/uint	transmit int/uint parameter value
2	long	transmit long parameter value
4	int/uint array	transmit int/uint array parameter value
5	long array	transmit long array parameter value
7	-	Order cannot be executed
8	-	no control rights for PKW interface

- If the order ID = 7 (order not executable), an error message is shown in PWE-low (byte 6/7).
- If response code = 8 (no control rights), the master is not entitled to write to the slave.

9.1.3 Error message

Encoding of error messages in response data set PWE-Low/Low-Byte in byte 7 (Slave ➜ Master):

Error no. (dec.) according to PROFIDRIVE	Meaning
0	non-permissible parameter number PNU
1	Parameter value cannot be edited
2	lower or upper parameter value limit exceeded
3	faulty data set
4	no data set switchable parameter
5	wrong data type
18	other error
20	system bus does not respond

Extension	Meaning
101	Parameter cannot be read:
103	Error when reading EEPROM
104	Error when writing EEPROM
105	EEPROM checksum error occurred
106	Parameter must not be written in operation
107	Values of data sets are different
108	Unknown order

Error number "20" may have different causes.
- If you do not use System Bus: Check if the low byte is "0" (zero). With values greater than zero an attempt is made to address a System Bus client instead of the Profibus client.
- If you use System Bus (e.g. via an EM-SYS module), the addressed device is not responding. Check if the addressed device is connected to power supply and the System Bus node addresses in the index low byte and in the parameter settings of the device to be addressed correspond to one another.

9.1.4 Communication procedure

An order from the master will **always** be answered by a slave response. Each parameter request or response can only accept one order/response at a time. For this reason, a defined handshake procedure must be followed between the master and slave.

In the initial situation, the order **and** response ID must be = 0. The master sets its order ID and waits until the slave changes the response ID from 0 to ≠ 0. Now, the slave's response is available and can be evaluated. Then, the master sets its order ID = 0 and waits until the slave changes the response ID from ≠ 0 to 0. This completes the communication cycle and a new cycle can start.

The slave will only respond to new orders once it has reacted to order ID = 0 with response ID = 0.
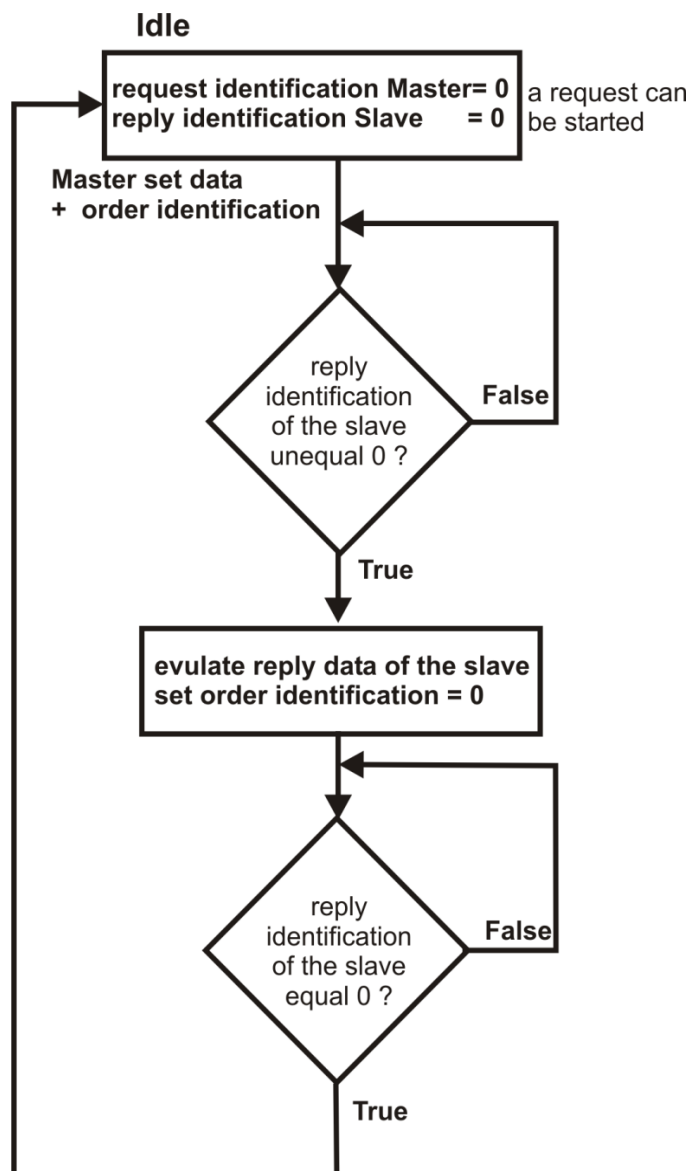
9.1.5 Parameters, data set selection and cyclic writing

For the parameters to be set, refer to the Operating Instructions according to the chosen configuration. The parameter list specifies if a parameter is switchable (Data set/INDEX = 1 through 4) or is available once only (Data set/INDEX = 0).

The parameter list also provides information about the display format of a parameter and its type (int/uint/long). String parameters cannot be transmitted due to the possible number of bytes.

The transmitted values are always integer numbers. In the case of decimal values, the decimal point is not transmitted.

The IND word hands over the required data set of the parameter. In the present application, the existing parameters are assigned data set number 0; to enable switching among multiple parameters (switchable), a number from 1 through 4 is assigned.

The actual parameter value is transmitted in the PWE range; as 16-bit value (int/uint), it occupies PWEI, as 32-bit value (long) PWE-high and PWE-low, with the high-word being in PWE-high.

If parameters are set to data set = 0, each of the four data sets is set to the same 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. Otherwise, an error message will be displayed.

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 activated when the target data set is increased by five when specifying the data set (IND).

Enter in RAM only	
EEPROM	**RAM**
Entry in data set = 0	Data set(IND)= 5:
Entry in data set = 1	Data set (IND)= 6:
Entry in data set = 2	Data set (IND)= 7:
Entry in data set = 3	Data set (IND)= 8:
Entry in data set = 4	Data set (IND)= 9:

When writing to data set switchable parameters, note:

Via data set (IND) = 0, data set switchable parameters can be set to the same value in all data sets.

9.1.5.1 Communication examples

	Parameters				Settings		
No.	Description	Type	Write/ read	Format	Min.	Max.	Factory settings
400	Switching fre- quency	P-W	W/R	x	1	8	2
480	Fixed frequency 1	P[I]-D	W/R	xxxx.xx Hz	-999.00	999.00	5.00

Example 1

Parameter **400** is a type int word (P-W), is not data set switchable and is to be read.

Order from master:

```
AK    = 1 (order code = read parameter value)
PNU   = 400 (= 0x190)
IND   = 0
PWEh  = 0
PWEl  = 0
```

PKW range							
Designa- tion	**PKE**		**IND**		**PWE-high**		**PWE-low**	
Contents	**Parameter ID**		**Index**		**Parameter val- ue high word**		**Parameter val- ue low word**	
	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x11	0x90	0	0	0	0	0	0
Byte no.	0	1	2	3	4	5	6	7

Response from slave:

```
AK    = 1 (response code = transmit int/uint parameter value)
PNU   = 400 (= 0x190)
IND   = 0
PWEh  = 0
PWEl  = value
```

PKW range							
Designa- tion	**PKE**		**IND**		**PWE-high**		**PWE-low**	
Contents	**Parameter ID**		**Index**		**Parameter val- ue high word**		**Parameter val- ue low word**	
	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x11	0x90	0	0	0	0	0	Value
Byte no.	0	1	2	3	4	5	6	7

Example 2

Parameter 480 is a type long double word (P[I]-D), is data set switchable and is to be written. The target data set is Data set 3.

Reference value = -300.00 Hz (-30000 is transmitted)

According to integer arithmetics, the negative value is represented as follows: 0xFFFF8AD0

Order from master:

AK = 8 (order code = write long array parameter value)
PNU = 480 (= 0x1E0)
IND = 3
PWEh = 0xFFFF
PWEl = 0x8AD0

PKW range							
Designa-tion	PKE		IND		PWE-high		PWE-low	
Contents	Parameter ID		Index		Parameter value high word		Parameter value low word	
	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x81	0xE0	3	0	0xFF	0xFF	0x8A	0xD0
Byte no.	0	1	2	3	4	5	6	7

Response from slave:

AK = 5 (order code = transmit long array parameter value)
PNU = 480 (= 0x1E0)
IND = 3
PWEh = 0xFFFF
PWEl = 0x8AD0

PKW range							
Designation	PKE		IND		PWE-high		PWE-low	
Contents	Parameter code		Index		Parameter value high word		Parameter value low word	
	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
	0x51	0xE0	3	0	0xFF	0xFF	0x8A	0xD0
Byte no.	0	1	2	3	4	5	6	7

9.1.6 Handling of index parameters / cyclic writing

Index parameters are used for various 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 parameter
		Write EEPROM and read	Write RAM	
PLC function (Function Table)	**1343** *FT Instruction* **1344** *FT Input 1* **1345** *FT Input 2* **1346** *FT Input 3* **1347** *FT Input 4* **1348** *FT Parameter 1* **1349** *FT Parameter 2* **1350** *FT Target Output 1* **1351** *FT Target Output 2* **1352** *FT Comment*	$0^{1)}$; 1...32	$33^{1)}$; 34...65	**1341** Write **1342** Read
Multiplexer	**1252** *Mux Input*	$0^{1)}$; 1...16	$17^{1)}$; 18...33	**1250** Write **1251** Read
CANopen multiplexer	**1422** *CANopen Mux Input*	$0^{1)}$; 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.

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.

9.1.6.1 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.

9.1.6.2 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 **1344** *PLC Input 1* (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.

9.2 Parameter access through reading/writing of data sets

The PROFINET communication module CM-PROFINET features the PROFINET data set access function. This feature can be used as an alternative to the PKW communication object in the data exchange object. The PKW object is always sent to the bus, regardless of whether it is currently being used or not. Thus, it produces unnecessary bus load.

Data set access messages for parameter access are special PROFINET messages which are sent only if a parameter is required. Unlike in the case of PKW objects, data access messages can access all parameter types, including string type parameters.

The S7 PLC uses two special functions, **SFC58 WR_REC** and **SFC59 RD_REC**, for data set access. Addressing is carried out based on the diagnosis address of the device to be accessed (Slot 0 / Sub-slot 1 / Index). "Index" addresses the accessed parameters using the following code:
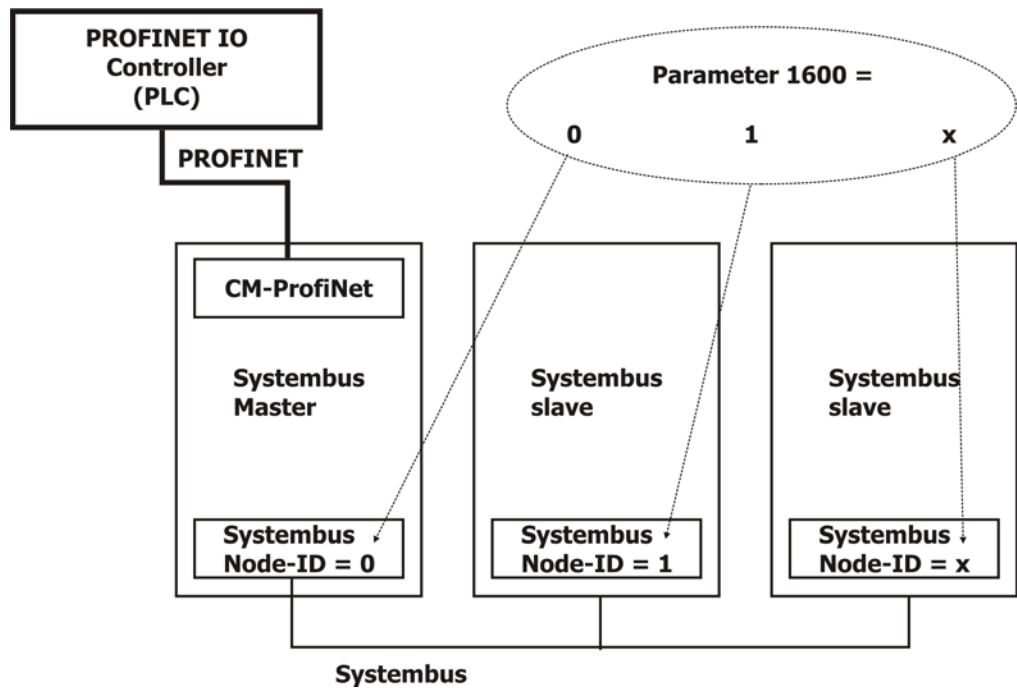
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	Data set				Parameter number										

Permissible index range = 0 … 0x7FFF

Data types and byte arrangement

Byte	0	1	2	3	4	5	…	….	max. 98
Data type	uint/int								
Contents	high byte	low byte							
Data type	long								
Contents	high byte			low byte					
Data type	string								
Contents	first char.								

uint/int   = 2 bytes
long   = 4 bytes
string   = 1 … 99 bytes

In order to access the parameters of the individual frequency inverters through System Bus, Parameter **1600** is set to the ID of the relevant System Bus node.

The data type of **1600** is an unsigned integer, value range 0...63.

Parameter **1600** can be read and written.

9.3 Process data channel

This chapter describes how to handle the PZD objects . For a description of the required process data objects PZD1/2, refer to Chapters 10.1 "Control via contacts/remote contacts", 10.2 "Control via state machine" and 10.2.4 "Reference value/actual value".

Objects PZD 3 ... 12 can be used application-specifically. In the frequency inverter, these objects are represented as sources for PZD Out objects (data received from PROFINET controller) and as input parameters for sources (data to be sent to the master).

Inputs and outputs are as seen from the point of view of the PROFINET controller.

9.3.1 Data types of OUT/IN objects

Data type "Boolean"

Permissible values of "Boolean" are FALSE/0x0000 and TRUE/0xFFFF.

Data type – Boolean		
	Boolean value	**Data contents Hexadecimal**
OUT/IN-PZDn Boolean	FALSE	0x0000
OUT/IN-PZDn Boolean	TRUE	0xFFFF

n = 3 ... 12

Data type "Word"

The "Word" data type can be used for percentage, current and torque variables. Current and torque variables are possible in applications with field-oriented control. The standardization is as described below.

Word data type "Percentage"

The range for percentage values is -300.00% ... +300.00%. The values in OUT/IN-PZDn are shown with a factor of 100.

Word data type – Percentage			
	Data contents Hexadecimal	**Data contents Decimal**	**Logical interpretation**
OUT/IN-PZDn word	0x8AD0	- 30000	- 300.00%
OUT/IN-PZDn word	0x0000	0	0.00%
OUT/IN-PZDn word	0x7530	+ 30000	+ 300.00%

n = 3 ... 12

Word data type "Current"

A device-internal standardization conversion is performed for the current.
The standard is as follows:

Reference value = (Reference current [A] / Standard current [A]) · 2^{13}

2^{13} = 8192 (decimal) = 0x2000 (hexadecimal)

Word data type "Torque"

A device-internal standardization conversion is performed for the torque. The standardization of a reference torque corresponds to that of a reference current (see "Word data type: Current"). If the machine is operated with a rated flux value, a reference torque corresponds to a reference current.

The specified equation for reference current and reference torque applies to operation with the rated flux value. This must be considered when a machine is operated in the field weakening range.

The device-internal standard must be considered when current or torque variables are used.

Data type "Long"

The "Long" data type can be used for frequency variables.

Frequencies use the internal representation of the frequency inverter $(xxx\ Hz\ /\ 4000\ Hz)\ *\ 2^{31}$.

Examples:

50.00 Hz ➔ $(50.00\ /\ 4000.00)\ *\ 2^{31}$ = 0x01999999
-80.00 Hz ➔ $(-80.00\ /\ 4000.00)\ *\ 2^{31}$ = 0xFD70A3D8

Data type – Long			
	Data contents Hexadecimal	**Data contents Decimal**	**Logic reproduction**
OUT/IN-PZDx/y Long	0xnnnnmmmm	Application specific	Application specific

x/y = 3/4, 5/6, ... 11/12

9.3.2   PROFINET output sources (OUT-PZD x)

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

- Availability of output sources depends on the number of configured PZD objects.
- Each configured PZD object comprises either two Boolean, two Word or one Long output object(s).
- A PZD output object can only be used for one data type (depending on the requirements of the application).
- The first PZD object configured (obligatory) represents PZD1/2 with fixed contents and functions.

Number of configured PZD objects	Boolean sources		Word sources		Long sources	
	Identification	**Source no.**	**Identification**	**Source no.**	**Identification**	**Source no.**
2	Out-PZD3 Boolean	640	Out-PZD3 Word	656	Out-PZD3/4 Long	672
	Out-PZD4 Boolean	641	Out-PZD4 Word	657		
3	Out-PZD5 Boolean	642	Out-PZD5 Word	658	Out-PZD5/6 Long	673
	Out-PZD6 Boolean	643	Out-PZD6 Word	659		
4	Out-PZD7 Boolean	644	Out-PZD7 Word	660	Out-PZD7/8 Long	674
	Out-PZD8 Boolean	645	Out-PZD8 Word	661		
5	Out-PZD9 Boolean	646	Out-PZD9 Word	662	Out-PZD9/10 Long	675
	Out-PZD10 Boolean	647	Out-PZD10 Word	663		
6	Out-PZD11 Boolean	648	Out-PZD11 Word	664	Out-PZD11/12 Long	676
	Out-PZD12 Boolean	649	Out-PZD12 Word	665		

- Each source can be linked to an input parameter of the frequency inverter of the same data type. The method is the same as it is used for the System Bus receive objects.
- Boolean sources represent Boolean objects.
- Word sources represent percentage, current or torque objects.
- Long sources represent frequency objects.

9.3.3 PROFINET input parameters (IN-PZD x)

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

- Availability of input sources depends on the number of configured PZD objects.
- Each configured PZD object comprises either two Boolean, two Word or one Long input parameter(s).
- A PZD input object can only be used for one data type (depending on the requirements of the application).
- The first PZD object configured (obligatory) represents PZD1/2 with fixed contents and functions.

Number of configured PZD objects	Boolean parameter		Word parameter		Long parameter	
	Identification	Parameter no.	Identification	Parameter no.	Identification	Parameter no.
2	In-PZD 3 Boolean	1300	In-PZD 3 Word	1302	In-PZD 3/4 Long	1304
	In-PZD 4 Boolean	1301	In-PZD 4 Word	1303		
3	In-PZD 5 Boolean	1305	In-PZD 5 Word	1307	In-PZD 5/6 Long	1309
	In-PZD 6 Boolean	1306	In-PZD 6 Word	1308		
4	In-PZD 7 Boolean	1310	In-PZD 7 Word	1312	In-PZD 7/8 Long	1314
	In-PZD 8 Boolean	1311	In-PZD 8 Word	1313		
5	In-PZD 9 Boolean	1315	In-PZD 9 Word	1317	In-PZD 9/10 Long	1319
	In-PZD 10 Boolean	1316	In-PZD 10 Word	1318		
6	In-PZD 11 Boolean	1320	In-PZD 11 Word	1322	In-PZD 11/12 Long	1324
	In-PZD 12 Boolean	1321	In-PZD 12 Word	1323		

By default, the input parameters are set to Off or Zero, except Parameters **1302**, **1303**, **1307** and **1308**.

The default settings of input parameters **1302**, **1303**, **1307** and **1308** are:

In-PZD 3 Word **1302** = 770 PDP Effective Current
In-PZD 4 Word **1303** = 771 PDP Active Current
In-PZD 5 Word **1307** = 772 Warning Status
In-PZD 6 Word **1308** = 773 Error Status

- When an object is set to a certain source number, it must be ensured that the relevant objects have the preset values at the same place. This method is the same as is the one used in the case of objects for Systembus transmission (transmit objects).
- Boolean inputs represent Boolean objects.
- Word inputs represent percentage, current or torque objects.
- Long inputs represent frequency objects.

The displayed PDP active current depends on the type of control. In the case of field-oriented controls, the torque-forming current is displayed. In applications with U/f characteristic control, the active current also measured for the torque will be displayed.

The PDP effective current will always be positive. The torque-forming current and the active current are signed.

A positive current sign corresponds to motor operation mode.

A negative current sign corresponds to generator operation mode.

Current standardization

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

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

For internal standardization, the data set switchable parameter *Rated Current* **371** is used as the reference value.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
371	Rated current	$0.01 \cdot I_{FUN}$	$10 \cdot I_{FUN}$	I_{FUN}

9.4 Frequency conversion PDP-Word to internal representation

If the frequency inverter is equipped with a PROFINET module CM-PROFINET or an extension module with System Bus, the *Convert PDP/internal* function will be available. It converts frequency values with Profibus representation to frequency values with device-internal representation and vice versa, see Chapter 10.2.4 "Reference value/actual value".

Frequency conversion Profibus representation/ Internal representation
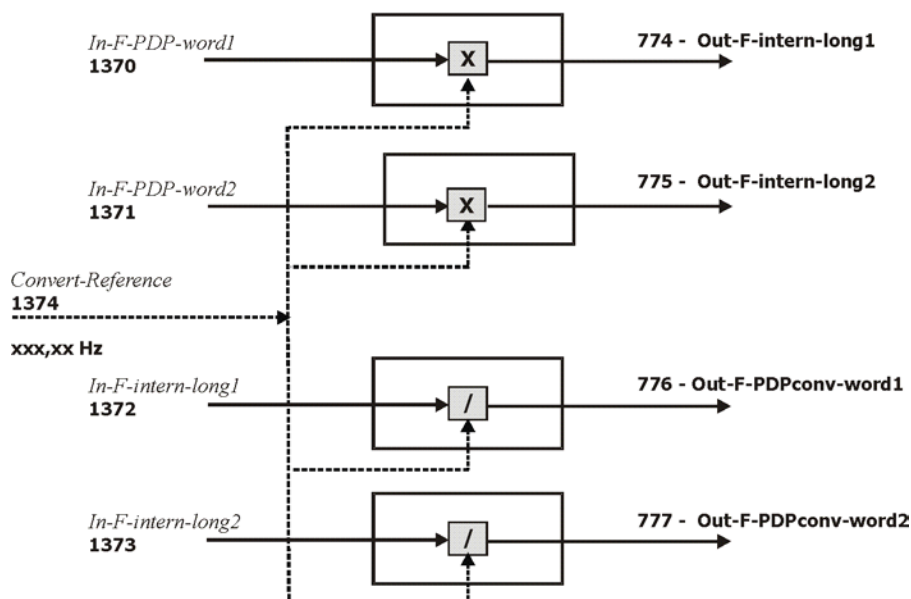
The standardization for In-F-PDP-word1/2 and Out-F-PDPconv-word1/2 is:

Standardization			
Reference Value	Binary	Decimal	Hexadecimal
+ 100%	+ 2^{14}	16384	0x4000
- 100%	- 2^{14}	49152	0xC000

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

The function uses its own reference value *Convert Reference* **1374** for data conversion. The advantage of this function is the fact that the "Word" data type is used for frequency values instead of the "Long" data type.

9.5 Resetting errors

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

- When using control via parameter *Local/Remote* **412** = Statemachine:
  Set bit 7 of control word PZD1 = 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
  Resetting via a digital signal is only possible if Parameter *Local/Remote* **412** permits this.

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

10 Control of frequency inverter

The master sends its control commands (control word) via the output object PZD1 to the frequency inverter and receives feedback about its status via a status word (status word).

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	Local/Remote	0	44	44

For operation with PROFINET, only operation modes 0, 1 and 2 are relevant. The other settings refer to the control option via the control panel.

Operation mode	Function
0 - Control via contacts (Chapter 10.1)	The Start and Stop commands as well as the direction of rotation are controlled via digital signals.
1 - Control via state machine (Chapter 10.2)	The frequency inverter is controlled via the control word.
2 - Control via remote contacts (Chapter 10.1)	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 *Data set selection* **414** is used.

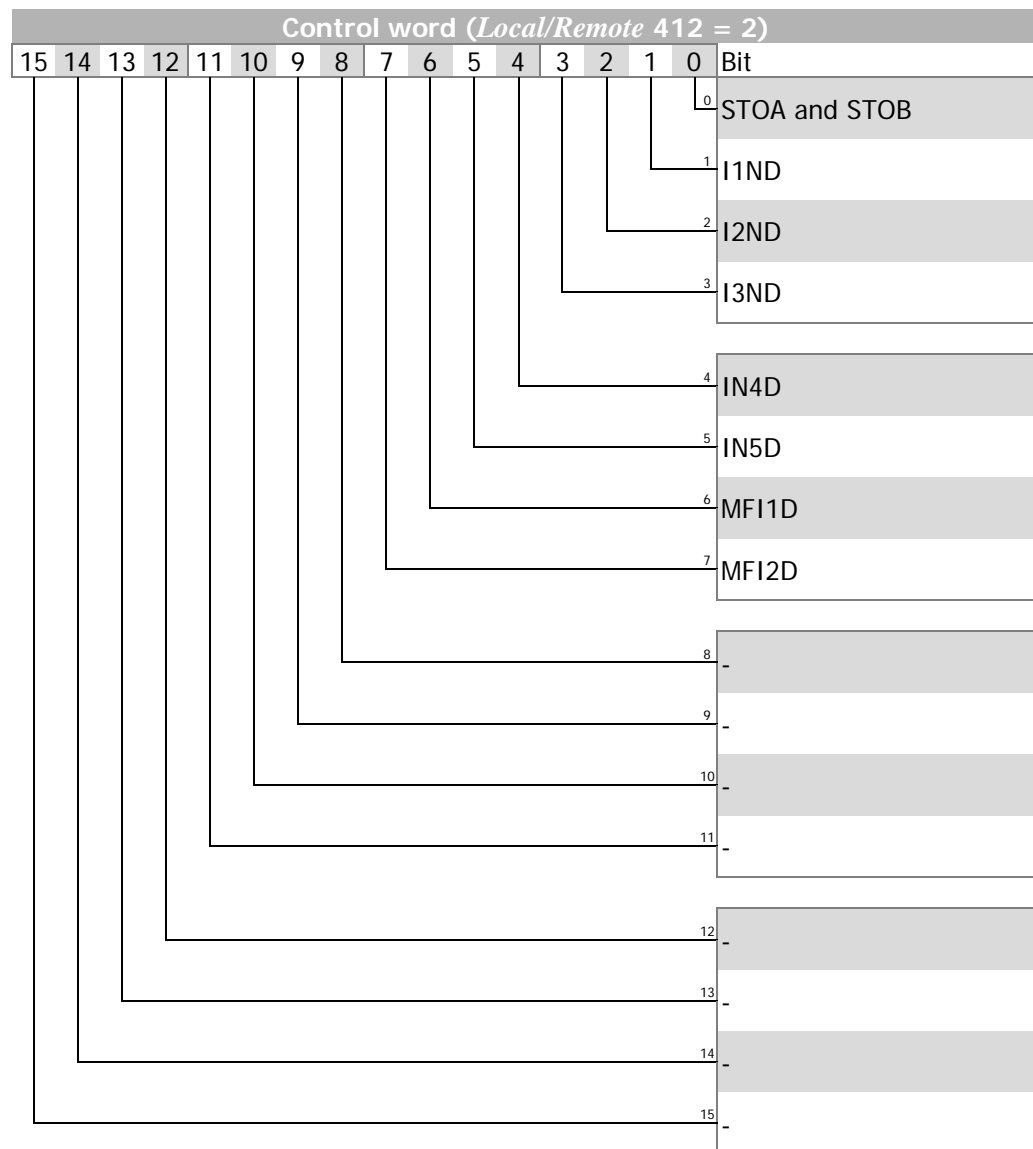| Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
414	Data set selection	0	5	0

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 section* **414** is set to 5, data set switching will only take place 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**.

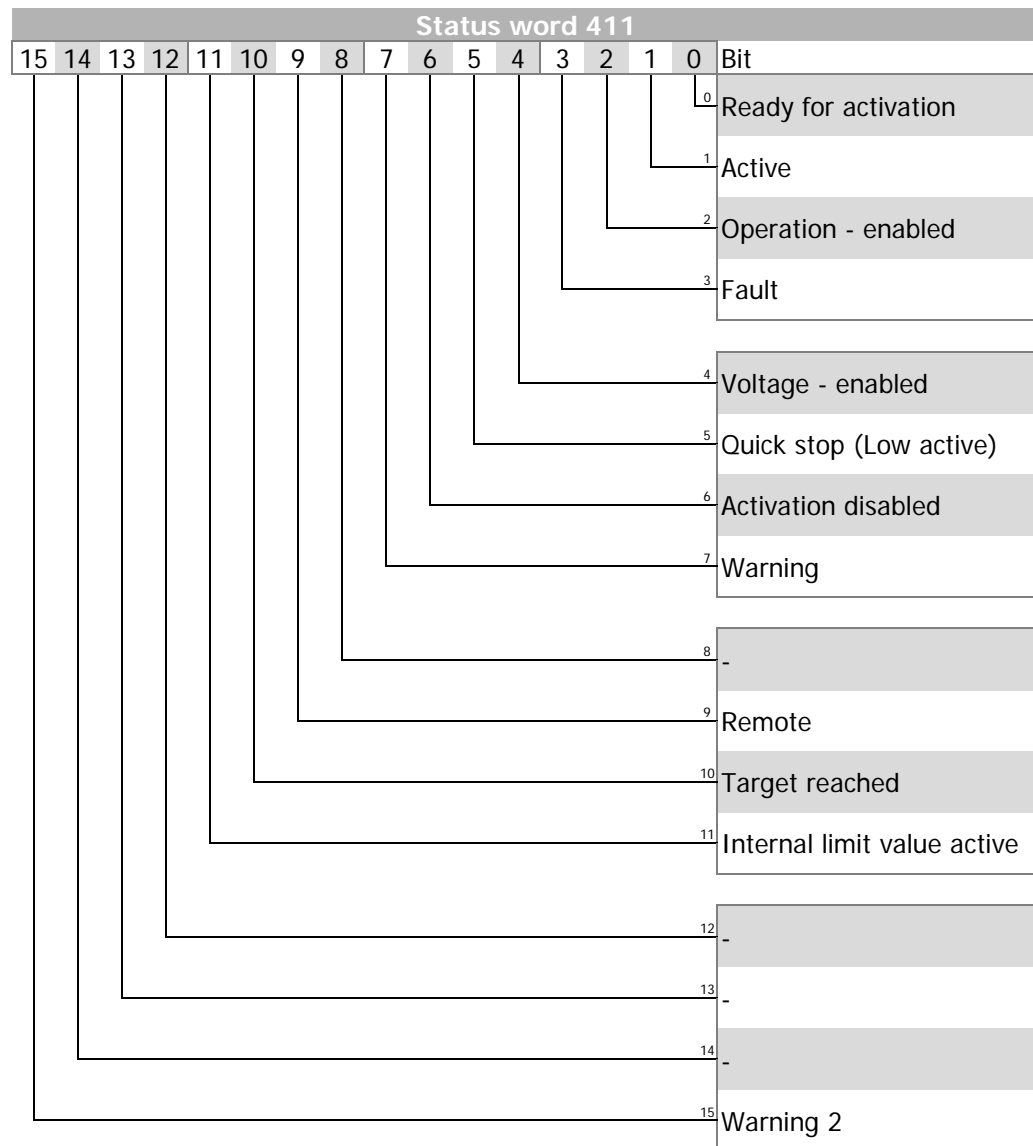## 10.1 Control via contacts/remote contacts

In PZD1, the master sends its control words, via the output data set, to the frequency inverter and receives information about the frequency inverter (status words) via the input data set.

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 STO (STOA and STOB), IN1D through MFI2D 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.

Control word (*Local/Remote* 412 = 2)																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit

- 0: STOA and STOB
- 1: I1ND
- 2: I2ND
- 3: I3ND
- 4: IN4D
- 5: IN5D
- 6: MFI1D
- 7: MFI2D
- 8: -
- 9: -
- 10: -
- 11: -
- 12: -
- 13: -
- 14: -
- 15: -

The digital inputs set via the control word can be monitored using parameter *Digital inputs* **250**. Digital input STO 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" is set in all data sets used.

Status word 411																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit

Bit	Description
0	Ready for activation
1	Active
2	Operation - enabled
3	Fault
4	Voltage - enabled
5	Quick stop (Low active)
6	Activation disabled
7	Warning
8	-
9	Remote
10	Target reached
11	Internal limit value active
12	-
13	-
14	-
15	Warning 2

> ℹ 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.

> ℹ AGL 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.

10.1.1 Device state machine

State machine:
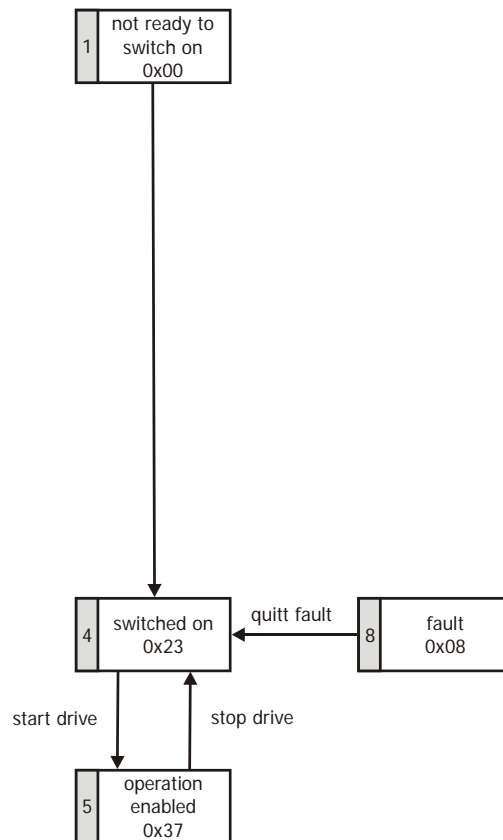
Status word	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
Switched on	1	0	0	1	1
Operation enabled	1	0	1	1	1
Fault	x	1	x	x	x

ℹ "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.

10.2 Control via state machine

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

Transition 4 and 4' to status "Operation enabled" is only possible if the controller release is set via STOA and STOB, and one of the digital inputs IN1D or IN2D is set. (Typically: I1ND = Start clockwise/IN2D = Start anticlockwise)

PZD1 / Parameter *Control word* **410** is applicable to the frequency inverter if parameter *Local/Remote* **412** is set to "1 – Control via state machine".

Control word 410																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit

0 Switch on
1 Enable voltage
2 Quick stop (Low active)
3 Enable operation
4 -
5 -
6 -
7 Fault reset
8 -
9 -
10 -
11 -
12 -
13 -
14 -
15 -

Status word 411																
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit

Bit	Description
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	Manufacturer-specific Warning 2

The 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 "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 start.

10.2.1   State machine diagram

State machine:
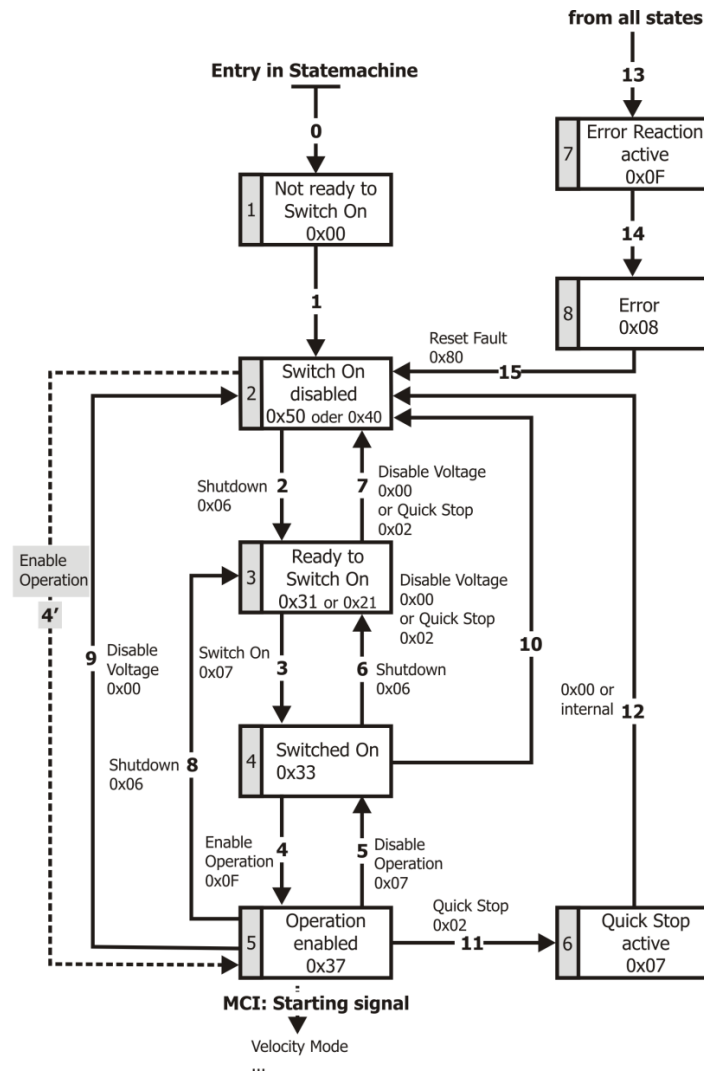
Control word:
The device control commands are triggered by the following bit patterns in the status word.

Command	Bit 7 Fault reset	Bit 3 Enable operation	Bit 2 Quick stop (Low active)	Bit 1 Enable voltage	Bit 0 Start	Transitions
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 (Command "Enable operation" [0xF]) will only be processed if the release is set via the hardware contacts STO.
If the hardware release via STO is not set, the frequency inverter will remain in status "Switched On" [0x33] until the hardware release via STO is present.
In status "Operation enabled" [0x37], the device will switch to status "Switched On" [0x33] internally once the hardware release via STO is reset.

Status word:
The status word indicates the current operating state.

Status word						
	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
State	**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 error 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 once the reference speed set in OUT-PZD2 has been 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 user manual).

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.

10.2.2 Behaviour in the case of a quick stop

In quick stop, the parameters *Switch-off threshold* **637** (percentage of parameter *Maximum Frequency* **419**) and *Holding time* **638** (holding time after falling short of the switch-off threshold) are relevant. 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**.
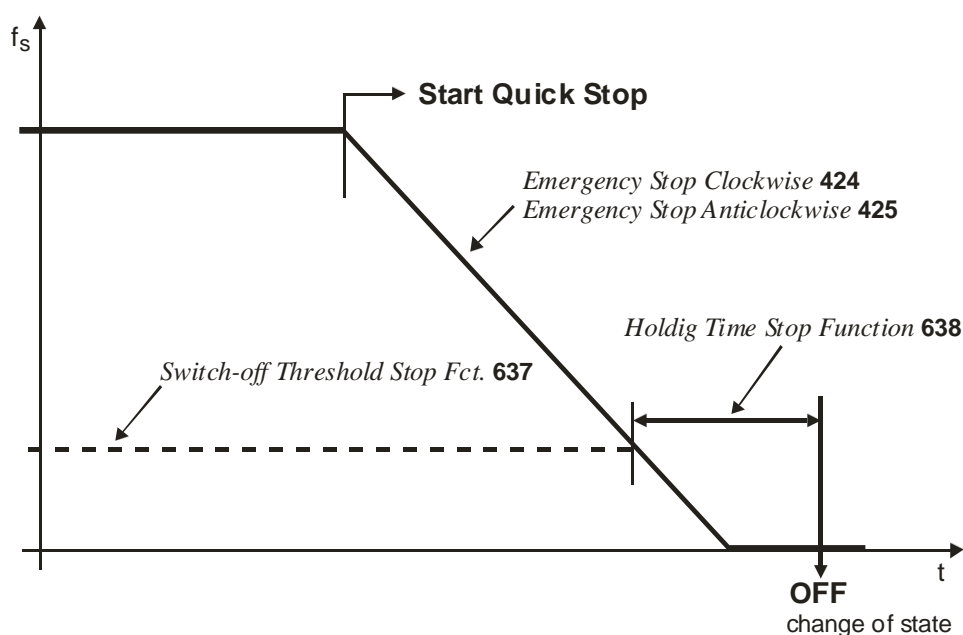
If frequency/speed reaches the value zero during the switch-off time, the drive continues to be supplied with current until the switch-off time has elapsed. This ensures that the drive is at a standstill when the state changes.

10.2.3 Behaviour in the case of transition 5 (disable operation)

The behaviour 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.

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.** 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 behaviour 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.

10.2.4   Reference value/actual value

In PZD2, the master sends its reference value to the frequency inverter in its output data set and receives information about the actual value in its input data set.

The use of the reference/actual value channel depends on the set configuration (control method). The actual value is generated according to the control method use.

The reference value and actual value refer to parameter *Rated frequency* **375** **OR** *Profibus/PROFINET Reference* **390**.

The distinction is made based on the setting of parameter *Profibus/PROFINET reference* **390**. If *Profibus/PROFINET reference* **390** = 0, the values are obtained from *Rated frequency* **375**. If *Profibus/PROFINET reference* **390** ≠ 0, *Profibus/PROFINET reference* **390** is used. Both parameters are data set switchable.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
375	Rated frequency	10.00 Hz	1000.00 Hz	50.00 Hz
390	Profibus/PROFINET reference	0.00 Hz	999.99 Hz	0.00 Hz

The reference and actual value are transmitted in standardized form. Standardization is effected through the variable used as the reference variable (*Rated frequency* **375** **OR** *Profibus/PROFINET reference* **390**).

Standardization			
Reference value	Binary	Decimal	Hexadecimal
+ 100 %	+ 2^{14}	16384	0x4000
- 100 %	- 2^{14}	49152	0xC000

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

Example: In Parameter *Profibus/PROFINET reference* **390**, the rated frequency of 60.00 Hz is set. The required reference frequency is 30.00 Hz. Since this is 50 % of the reference value, 8192 (0x2000) must be transmitted as the reference value.

With the reference variable *Profibus PROFINET reference* **390**, a machine can be operated in the field weakening range above its reference frequency.

Example: Parameter *Rated frequency* **375** is set to 50.00 Hz. With the setting of parameter *Profibus/PROFINET reference* **390** to 100.00 Hz, the value range ±200 Hz is possible.

The reference value for the frequency inverter from PZD2 is supplied via the reference line value. This reference value is combined in the input of the ramp function with the internal reference frequency from the reference frequency channel. For information on the reference frequency channel, refer to the frequency inverter Operating Instructions.
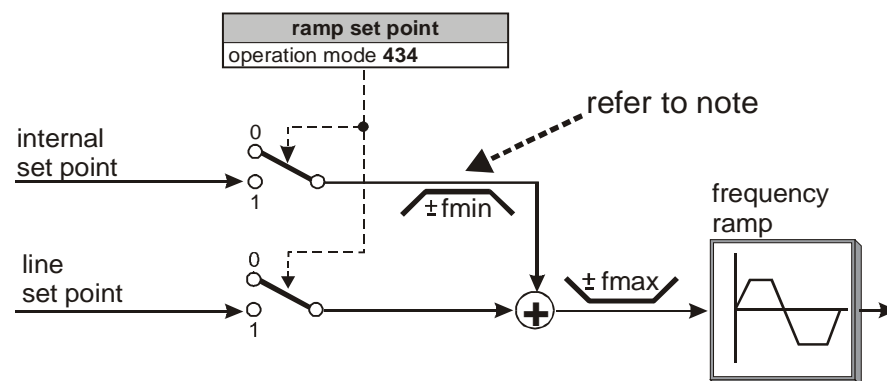
The internal reference value from the reference frequency channel and the reference line value can be fed to the ramp individually or as an added variable. The operation mode of the ramp function is set via the data set switchable parameter *Ramp setpoint* **434**.

Parameters		Settings		
No.	Description	Min.	Max.	Factory setting
434	Ramp setpoint	1	3	3

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

The Internal reference frequency can be controlled via the frequency inverter with the control unit KP500 or the control software VPlus, the reference line value is supplied via PZD2.

> If *Ramp setpoint* **434** = 2 (reference line value only), this reference line value is limited to fmin.
> The sign in front of fmin with reference value = 0 is derived from the sign in front of the last reference line value which was not 0.
> After Mains On, the reference line value is limited to +fmin.

For *Ramp setpoint* **434** = 3, the sign of the total reference value results from the total of internal reference frequency and reference line value.

Actual values		
Parameters	**Contents**	**Format**
Internal reference frequency **228**	Internal reference value from the reference frequency channel	xxx.xx Hz
Reference bus frequency **282**	PROFINET reference line value	xxx.xx Hz
Reference ramp frequency **283**	= sum of internal reference frequency + reference line value	xxx.xx Hz

10.2.5 Sequence example

One of the following sequences can be used:

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

11 Parameter List

The parameter list is structured according to the menu branches of the control unit. 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 SETUP routine

⊗ This parameter cannot be written when the frequency inverter is in operation.

11.1 Actual values

No.	Description	Unit	Indication range	Chapter
Actual values of frequency inverter				
228	Internal reference frequency	Hz	-1000.00 ... 1000.00	10.2.4
249	Active dataset	-	1 ... 4	10
250	Digital inputs	-	0 ... 255	10.1
260	Current error	-	0 ... 0xFFFF	12.5
270	Warnings	-	0 ... 0xFFFF	12.3
274	Warning application	-	0 ... 0xFFFF	12.4
282	Reference bus frequency	Hz	-1000.00 ... 1000.00	10.2.4
283	Reference ramp frequency	Hz	-1000.00 ... 1000.00	10.2.4

Parameters *Current error* **260**, *Warnings* **270** and *Application warnings* **274** are only accessible via the communication channel of objects PPO1 and PPO2. They cannot be addressed via the VPlus control software or the control panel.

11.2 Parameters

	No.	Description	Unit	Setting range	Chapter
		Rated motor values			
▣	371	Rated current	Hz		9.3.3
▣	375	Rated frequency	Hz	10.00 ... 1000.00	10.2.4
		PROFINET			
	388	Bus Error Behaviour	-	0 ... 5	7.5
▣	390	Profibus/PROFINET reference	Hz	0.00 ... 999.99	10.2.4
		Bus control			
	392	Transition 5	-	0 ... 5	10.2.3
▣	412	Local/Remote	-	0 ... 44	10
		Data set switching			
	414	Data set selection	-	0 ... 4	10
		Frequency ramps			
▣	424	Emergency Stop Clockwise	Hz/s	0.01 ... 9999.99	10.2.2
▣	425	Emergency Stop Anticlockwise	Hz/s	0.01 ... 9999.99	10.2.2
▣	434	Reference Ramp	-	1 ... 3	10.2.4
		Digital outputs			
	549	Max. Control deviation	%	0.01 ... 20.00	10.1.1, 10.2.1
		Stopping behaviour			
▣	637	Switch-off threshold	%	0.0 ... 100.0	10.2.2, 10.2.3
▣	638	Holding time	s	0.0 ... 200.0	
		Profibus			
	1300	In-PZD 3 Boolean	-		9.3.3
	.	all In-PZD parameters			
	1324	In-PZD 11/12 Long	-		

1)

non-volatile (fixed parameterization)		Volatile:	
0:	all indexes in EEPROM	17:	all indexes in RAM
1...16	One index in EEPROM	18...33	One index 1...16 in RAM

> **ℹ** Parameter *Data set selection* **414** is accessible via the communication channel. It cannot be addressed via the VPlus control software or the control panel.

12 Appendix

12.1 List of control words

The following table provides an overview of the functions of the **control word** bits if Control via state machine (*Local/Remote* **412** = "1 - Control via statemachine").

Bit	AGL Control word
0	Switch On
1	Enable Voltage
2	Quick Stop
3	Enable Operation
4	
5	
6	
7	Fault reset
8	
9	
10	
11	
12	
13	
14	
15	

12.2 List of status words

The following table provides an overview of the functions of the **status word** bits if Control via state machine (*Local/Remote* **412** = "1 - Control via statemachine").

Bit	AGL Status word
0	Ready to Switch On
1	Switched On
2	Operation enabled
3	Fault
4	Voltage enabled
5	Quick Stop
6	Switch On Disabled
7	Warning
8	
9	Remote
10	Target reached
11	Internal limit active
12	
13	
14	
15	Warning 2

12.3 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 communication The bit-coded warning reports are issued via parameter *Warnings* **270** according to the following pattern:

Parameter *Warnings* **269** indicates the warnings as plain text in the control panel and the VPlus PC control software.

Use parameter *Warnings* **270** in order to read the warning messages via Field Bus.

Warning messages		
Bit no.	**Warning code**	**Description**
0	0x0001	Warning Ixt
1	0x0002	Warning short-time Ixt
2	0x0004	Warning long-time Ixt
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 MFI2A
13	0x2000	Warning System Bus
14	0x4000	Warning Udc
15	0x8000	Warning *Application warnings* **273**

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

12.4 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	0
1	0x0002	(reserved)	1
2	0x0004	(reserved)	2
3	0x0008	(reserved)	3
4	0x0010	(reserved)	4
5	0x0020	(reserved)	5
6	0x0040	SERVICE	6
7	0x0080	User 1	7
8	0x0100	User 2	8
9	0x0200	(reserved)	9
10	0x0400	(reserved)	10
11	0x0800	(reserved)	11
12	0x1000	(reserved)	12
13	0x2000	(reserved)	13
14	0x4000	(reserved)	14
15	0x8000	(reserved)	15

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

12.5 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**
F27	14	Communication loss to PLC*
	50	PNIO Configuration Error (wrong configuration of cyclic data objects PZD)

* This message is only displayed if *Bus Error Behaviour* **388** ≠ **0.**
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.

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