Bonfiglioli
Vectron

Agile

VABus Communication manual
Frequency inverter 230V / 400V

Bonfiglioli
power, control and green solutions

Content

1 General Information on the Documentation

This documentation describes the communication with *Agile* device series frequency inverters using the VABus protocol. The modular hardware and software structure allows user-friendly customization of the frequency inverters. Applications which demand high functionality and dynamics can be comfortably implemented.

1.1 Instruction Manuals

For better clarity, the user documentation is structured according to the customer-specific demands made on the frequency inverter.

Quick Start Guide
The "Quick Start Guide" brief instructions manual describes the basic steps for the mechanical and electrical installation of the frequency inverter. The guided commissioning supports you with the selection of the necessary parameters and the configuration of the software.

Operating Instructions
The Operating Instructions documents the complete functionality of the frequency inverter. The parameters necessary for specific applications for adaptation to the application and the extensive additional functions are described in detail.

Application Manual
The application manual supplements the documentation for purposeful installation and commissioning of the frequency inverter. Information on various subjects connected with the use of the frequency inverter is described specific to the application.

The documentation and further information can be requested from the local BONFIGLIOLI representative.

The following instruction manuals are available for the *Agile* device series:

Agile Operating Instructions	Frequency inverter functionality.
Agile Quick Start Guide	Installation und commissioning. Supplied with the device.
Communication Application-Manuals	Communication via the RS485 Interface on the X21-Connection (RJ45): Instructions for Modbus and VABus. Communication via the X12.5 and X12.6 Control Terminals: Instructions for Systembus and CANopen®[1]. Communication via the Communication Modules: CM-232/CM-485: Instructions for Modbus and VABus. CM-CAN: Instructions for Systembus and CANopen®. CM-PDPV1: Instructions for Profibus-DP-V1
PLC Application Manual	Logical interconnections of digital signals. Functions for analog signals such as comparisons and mathematical functions. Graphical support for the programming of functional components.
Service Instructions	For service personnel. Service work, monitoring of service intervals and replacement of ventilators.

This documentation has been produced with the greatest of care and extensively and repeatedly checked. For reasons of clarity, not all the detailed information on all types of the product and also not every imaginable case of installation, operation or maintenance has been taken into account. If you require further information or if specific problems which are not dealt with extensively enough in the documentation exist, you can request the necessary information from the local BONFIGLIOLI representative.

[1] The CANopen®-Communication products fulfill the specifications of the CiA® (CAN in Automation) user organization.

We would also point out that the contents of this documentation are not part of a previous or existing agreement, assurance or legal relationship and are not intended to amend the same. All obligations of the manufacturer result from the underlying purchase contract, which also contains the complete and solely valid warranty regulation. These contractual warranty provisions are neither extended nor limited by the production of this documentation.

The manufacturer reserves the right to correct or amend the contents and the product information as well as omissions without prior notification and assumes no kind of liability for damage, injuries or expenditure to be put down to the aforementioned reasons.

1.2 Used Pictograms and Signal Words

The following pictograms and signal words are used in the documentation:

Danger!

Danger refers to an immediate threat. Non-compliance with the precaution described will result in death, serious injury or material damage.

Warning!

Warning refers to a possible threat. Non-compliance with the warning may result in death, serious injury or material damage.

Caution!

Caution refers to an immediate hazard. Non-compliance may result in personal or material damage.

Attention!
Attention and the related text refer to a possible behavior or an undesired condition which can occur during operation.

Note
Marks information that facilitates handling for you and supplements the corresponding part of the documentation.

2 General Safety Instructions and Information on Use

Warning!

The specifications and instructions contained in the documentation must be complied with strictly during installation and commissioning. Before starting the relevant activity, read the documentation carefully and comply with the safety instructions. The term "Qualified Staff" refers to anybody who is familiar with the installation, assembly, commissioning and operation of the frequency inverter and has the proper qualification for the job.

2.1 General Information

Warning!

The DC-link circuit of the frequency inverter is charged during operation, i.e. there is always the risk of contact with high voltage. Frequency inverters are used for driving moving parts and they may become hot at the surface during operation.

Any unauthorized removal of the necessary covers, improper use, wrong installation or operation may result in serious injuries or material damage.

In order to avoid such injuries or damage, only qualified technical staff may carry out the transport, installation, commissioning, setup or maintenance work required. The standards EN 50178, IEC 60364 (Cenelec HD 384 or DIN VDE 0100), IEC 60664-1 (Cenelec HD 625 or VDE 0110-1) as well as the applicable national regulations must be complied with. The term „Qualified Staff" refers to anybody who is familiar with the installation, assembly, commissioning and operation of the frequency inverter as well as the possible hazards and has the proper qualification for the job.

Persons who are not familiar with the operation of the frequency inverter and children must not have access to the device.

2.2 Purpose of the Frequency Inverters

Warning!

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/EEC and EN 60204. In accordance with the CE marking requirements, the frequency inverters comply with the Low Voltage Directive 2006/95/EC as well as EN 61800-5-1. The user shall be responsible for making sure that the requirements of the EMC Directive 2004/108/EEC are met. Frequency inverters are only available at specialized dealers and are exclusively intended for professional use as per EN 61000-3-2.

Purposes other than intended may result in the exclusion of warranty.

The frequency inverters are also marked with the UL label according to UL508c, which proves that they also meet the requirements of the CSA Standard C22.2-No. 14-95.

The technical data, connection specifications and information on ambient conditions are indicated on the name plate and in the documentation and must be complied with in any case. Anyone involved in any kind of work at the device must have read the instructions carefully and understood them before starting the work.

2.3 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. The units may be exposed to little temperature deviations only. Observe the conditions according to EN 60721-3-1 for storage, EN 60721-3-2 for transport and the marking on the packaging.

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

2.4 Handling and Installation

Warning!

Damaged or destroyed components must not be put into operation because they may be a health hazard.

The frequency inverters are to be used in accordance with the documentation as well as the applicable directives and standards.

They must be handled carefully and protected against mechanical stress.

Do not bend any components or change the isolating distances.

Do not touch electronic components or contacts. The devices are equipped with components which are sensitive to electrostatic energy and can be damaged if handled improperly. Any use of damaged or destroyed components shall be considered as a non-compliance with the applicable standards.

Removal of seal marks may cause restrictions on warranty.

Do not remove any warning signs from the device.

2.5 Electrical Installation

Warning!

Before any assembly or connection work, discharge the frequency inverter. Verify that the frequency inverter is discharged.

Do not touch the terminals because the capacitors may still be charged.

Comply with the information given in the operating instructions and on the frequency inverter label.

Comply with the rules for working on electrical installations.

Rules for working on electrical installation:

- Separate completely (isolate the installation from all possible sources of electrical power.
- Fix (protect against reconnection). Reconnection must be carried out by suitably qualified persons.
- Verify there is no electrical power. Verify that there is no voltage against earth on the plant component by measuring with measurement device or voltage tester.
- Ground and connect in a short circuit. Connect earth conductors.
- Protect against nearby power sources and delimit the working zone.

1) In plants with a nominal power up to 1 kV deviation from description may be possible.

When working at the frequency inverters, comply with the relevant accident prevention regulations, the applicable standards, standards governing work on systems with dangerous voltages (e.g. EN 50178), directives for electrical and mechanical equipment erection and other national directives.

Comply with the electrical installation instructions given in the documentation as well as the relevant directives.

Responsibility for compliance with and examination of the limit values of the EMC product norm EN 61800-3 for variable-speed electrical drive mechanisms is with the manu-facturer of the industrial plant or machine. The documentation contains information on EMC-conforming installation.

The cables connected to the frequency inverters may not be subjected to high-voltage insulation tests unless appropriate circuitry measures are taken before.

Do not connect any capacitive loads.

2.6 Information on Use

Warning!

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 is 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, Accident Prevention Directives etc.).

No connection work may be performed, while the system is in operation.

2.6.1 Using external products

Please note, that Bonfiglioli Vectron does not take any responsibility for the compatibility of external products (e.g. motors, cables, filters, etc.).

To ensure the best system compatibility, Bonfiglioli Vectron offers components which simplify commissioning and provide the best tuning with each other during operation.

Using the device in combination with external products is carried out at your own risk.

2.7 Maintenance and Service

Warning!

Unauthorized opening and improper interventions can lead to personal injury or material damage. Repairs on the frequency inverters may only be carried out by the manu-facturer or persons authorized by the manufacturer.

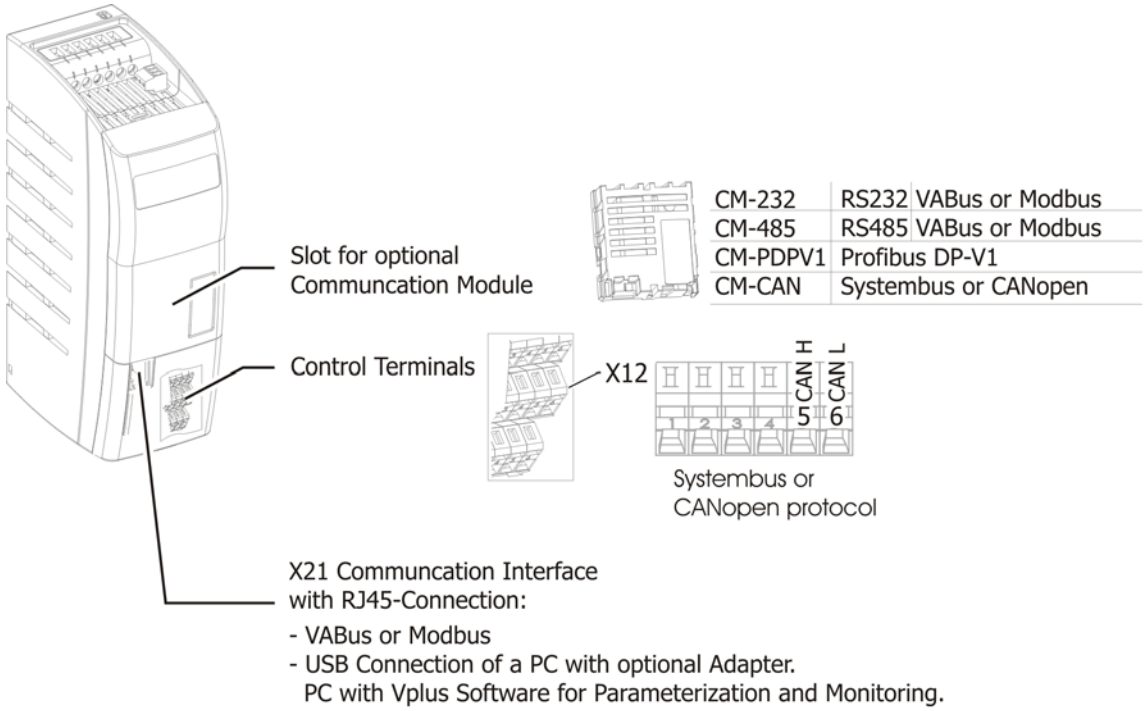
Check protective equipment regularly.

Any repair work must be carried out by qualified electricians.

2.8 Disposal

The dispose of frequency inverter components must be carried out in accordance with the local and country-specific regulations and standards.

3 Communication Options



Interface	See
X21[2]	Instructions for VABus or Modbus.
CM-232	Instructions for VABus or Modbus.
CM-485	Instructions for VABus or Modbus.
CM-PDPV1	Instructions for Profibus DP-V1.
CM-CAN	Instructions for Systembus or CANopen®[3].
Control Terminals CAN-Connection	Instructions for Systembus or CANopen®.

[2] Install an interface adapter for connection to a PC. This enables parameterization and monitoring via the VPlus PC-Software.

[3] The CANopen®-Communication products fulfill the specifications of the CiA® (CAN in Automation) user organization.

4 Installation of an optional Communication Module

This chapter describes the assembly and disassembly of the communication module.

4.1 Assembly

The communication module is pre-assembled in a casing. Additionally, a PE spring is enclosed for PE connection (shield).

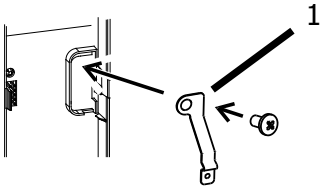
Caution!

The frequency inverter must be disconnected from the power supply before installation of the communication module.

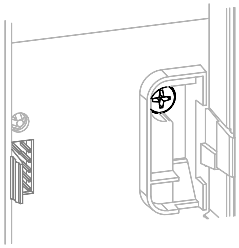
Installation under voltage is not permitted and will destroy the frequency inverter and/or the communication module.

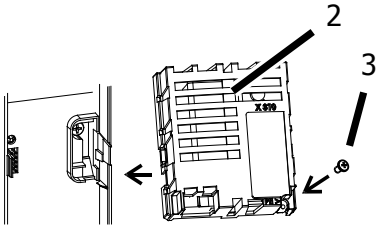
Do not touch the PCB visible on the back of the module, otherwise components may be damaged.

- Remove the cover of the module slot.



- Attach the PE spring (1) using the screw provided on the frequency inverter.

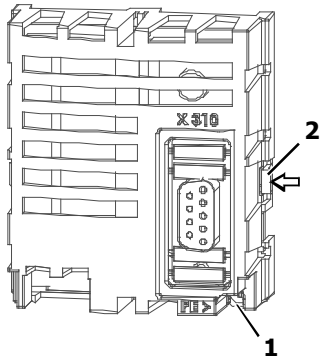




- Insert the communication module (2).
- Screw the communication module (2) onto the frequency inverter with the screw provided (3).
- Break off the pre-punched cut-out from the cover.
- Replace the cover.

4.2 Disassembly

- Remove the cover of the module slot.



- Loosen the screw (1) on the communication module.
- Using a small screwdriver, firstly unlock the right and then the left snap-in hook (2).
- Remove the communication module from the slot.
- Unscrew the PE spring.
- Replace the cover onto the frequency inverter.

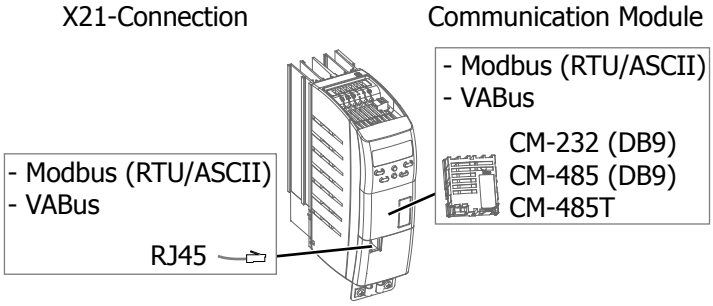
5 RS485 and RS232 Interfaces

The frequency inverter can be controlled from a PLC or another master device via a serial interface using the Modbus or VABus protocol. The VABus protocol is required for the parameterization with the VPlus PC-Software.

The connection can be established via the RJ45-Connector of the X21-Connection or via an optional communication module.

The following protocols can be selected:

- Modbus RTU
- Modbus ASCII
- VABus



The communication with the VABus-Protocol can be established via:

- the RJ45-Connector of the X21-Connection
- the CM-232 Communication Module with RS232-connection using a 9-pin D-Sub connector
- the CM-485 Communication Module with RS485-connection using a 9-pin D-Sub connector
- the CM-485T Communication Module with RS485-connection using a 7-pin terminal socket

The VABus communication is possible either via the RJ45-Connector of the X21-Connection or via an optional Communication Module. Simultaneous Modbus communication via the X21-Connection and an optional Communication Module is not possible.

Simultaneous VABus communication is possible via the X21-Connection and an optional Communication Module.

Possible Combinations of VABus with Modbus:

Communication Module		**X21 (RJ45)**
Modbus (RTU or ASCII)	and	VABus
VABus	and	Modbus (RTU or ASCII)
VABus	and	VABus

Combination Options with the Scope Function:

Communication Module		**X21 (RJ45)**
VABus	and	Scope Function (VABus)
Scope Function (VABus)	and	VABus
Scope Function (VABus)	and	Modbus (RTU or ASCII)
Modbus (RTU or ASCII)	and	Scope Function (VABus)

The Scope Function is started via the VPlus PC-Software. The Scope Function cannot be started via VPlus and an optional Communication Module at the same time.

The baud rates for the X21-Connection and the Communication Module can be set separately.

Note:
This document is not basic information for the RS232 or RS485 serial interface. Fundamental knowledge of the VABus protocol and the RS232 and RS485 serial interfaces is a prerequisite.

In some sections – as an alternative to control via the operator panel – settings and display possibilities are described with the help of the VPlus PC-Software. Here, VPlus communicates with the frequency inverter via the X21-Connection or via an optional CM-232 or CM-485 Communication Module.

If the serial interface of an optional CM-232 or CM-485 Communication Module is connected to a PLC, then simultaneous access to the frequency inverter from the VPlus PC-Software is no longer possible. In this case, the connection to the PC can be made via USB with the help of an optional interface adapter on the X21-Connection.

Warning!

Via the VABus-Communication, a control unit can access all of the frequency inverter parameters.

The changing of parameters, whose meaning is not known to the user, can lead to the malfunctioning of the frequency inverter and to dangerous situations in the plant.

Caution!

If values are to be written regularly with a high repetition rate, then no entry may be made to the EEPROM, as it only has a limited number of admissible write cycles (approx. 1 million cycles). If the number of allowed write cycles is exceeded then the EEPROM will be damaged. See Chapter 8 "Handling of Data Sets / Cyclic ".

RS485-Connection

Frequency inverters can be connected to a bus system using CM-485 Communication Modules. The bus structure is linear and implemented as a 2-wire line. Up to 247 frequency inverters can be addressed and polled from a bus master via VABus.

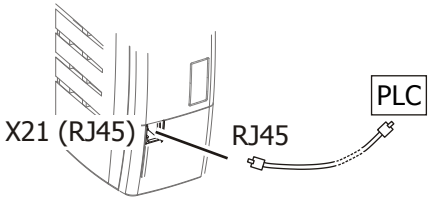
The frequency inverters can be parameterized and controlled via the bus system. During operation data can be requested and set from a PC or PLC.

RS232-Connection

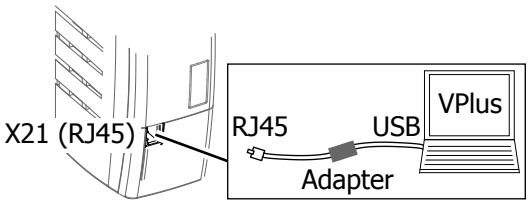
The RS232-Connection allows a point to point connection between the participants.

5.1 X21-Connection

The X21-Connection with the RJ45-Connector enables the connection to the RS485 interface of a PLC.



With an optional USB-Adapter the USB-Interface of a PC can be connected to the X21 Interface. This enables parameterization and monitoring using the VPlus PC-Software.



5.2 Communication Modules

Direct connection of the CM-232 to a PC or PLC

The CM-232 Communication Module enables a direct connection between a 9-pin D-Sub connector (X310) of the CM-232 and the serial interface of a PC or PLC.

The configuration of the installed communication module is carried out using the VPlus PC-Software or using the Operator Panel.

With CM-232 the connection to the PC or PLC is made via a RS232-Connection Line (1:1 occupancy).

Direct connection of the CM-485 to a PC or PLC

For the direct connection between the 9-pin D-Sub Interface (X310) of the CM-485 and the serial RS232-Interface of a PC or PLC, install an RS485/RS232 interface adapter on the signal line.

The configuration of the installed communication module is carried out using the VPlus PC-Software or using the Operator Panel.

Attention!
The transmitter and receiver must be set to the same transfer rate (baud rate).

The set baud rate applies to the CM-232 and CM-485 communication modules.

Work Steps:

- Mount the CM-232 / CM-485 Communication Module onto the frequency inverter.
- For the CM-232 Communication Module:
  Connect the CM-232 and PC with an RS232-Cable.
- For the CM-485 Communication Module:
  Connect the CM-485 with a RS485-Cable to the RS485/RS232 Interface Adapter.
  Connect the RS232-Connection of the Interface Adapter with the PC/PLC.

Setting the type of Protocol

The factory setting of the CM-232/CM-485 Communication Modules is the BONFIGLIOLI VECTRON standard protocol (VABus). Communication with the VPlus PC-Software is only possible using this protocol.

The VABus protocol enables the operation of a straight Master/Slave-System. The Bus-Master can be a PC, a PLC or any arbitrary computer system.

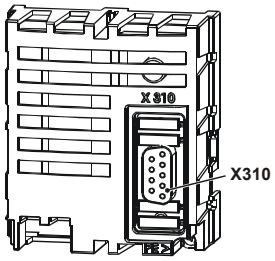
5.2.1 Installation Notes

- For the RS485 bus cable use a twisted, shielded cable.
- Implement the shield as a braided shield (not a foil shield).
- Connect the cable shield surfaces at both ends to PE.
- The connector pin assignments of an RS485-Cable and an RS232-Cable are different. No data transfer is possible if the wrong cable is used.

5.2.2 Pin Assignment

This chapter describes the Pin assignment of the usable modules.

5.2.2.1 RS232 Communication Module CM-232 DB9



The RS232-Interface is connected to a PC or a controller via the 9-pin D-Sub socket X310.

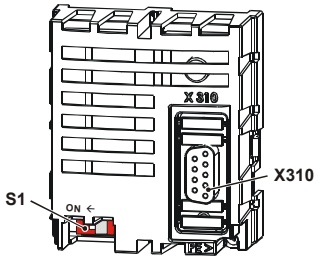
The assignment complies with the standard, so that only an RS232 connection cable (1:1) is required.

Bus Connector X310 CM-232 (9-pin D-Sub)

Pin	Name	Function
Housing	Shield	connected with PE
1	–	n. c.
2	RxD	receive data (input)
3	TxD	transmit data (output)
4	–	n. c.
5	0 V	Ground
6	–	n. c.
7	–	n. c.
8	–	n. c.
9	–	n. c.

n.c: not connected

5.2.2.2 RS485 Communication Module CM-485 DB9



The RS232-Interface is connected to a PC or a controller via the 9-pin D-Sub socket X310.

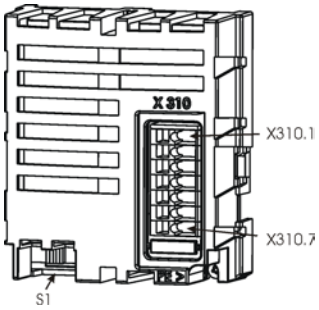
For details on the pin assignment, refer to the following table.

Bus Connector X310 CM-485 (9-pin D-Sub)

Pin	Name	Function
Housing	Shield	connected with PE
1	Data Line B	short-circuit proof and functionally insulated; max. current 60 mA
2	Data Line B'	same as pin 1 – for cable network
3	0 V	GND/earth
4	–	n. c.
5	+5 V	Interface converter supply voltage +5 V
6	–	n. c.
7	Data Line A	short-circuit proof and functionally insulated; max. current 60 mA
8	Data Line A'	same as pin 7 – for cable network
9	–	n. c.

n.c: not connected

5.2.2.3 RS485 Communication Module CM-485T



The RS485-Interface is connected via the 7-pin terminal socket X310.

For details on the pin assignment, refer to the following table.

Bus Connector X310 CM-485 T (7-pin terminal)

Terminal	Name	Function
1	Data Line A	short-circuit proof and functionally insulated; max. current 60 mA
2	Data Line A'	same as pin 1 – for cable network
3	Data Line B	short-circuit proof and functionally insulated; max. current 60 mA
4	Date Line B'	same as pin 3 – for cable network
5	+5 V	Interface converter supply voltage +5 V
6	0 V	GND/earth
7	PE	Shield

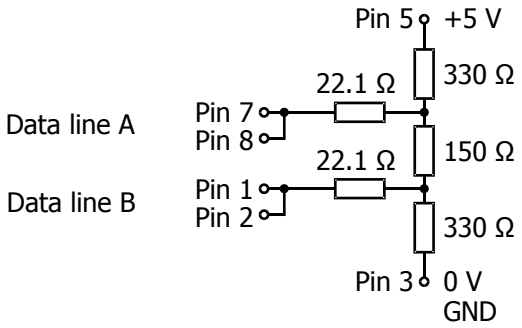
5.2.3 RS485 Bus Termination

Attention!
The passive bus termination (connection of a termination resistor), is required at the physically first and last client. It can be activated by the CM-485 and CM-485T DIP Switch S1.

By default, the bus termination is set to OFF.

It is important to implement a correct termination. Otherwise, no communication is possible via the RS485-Interface.

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

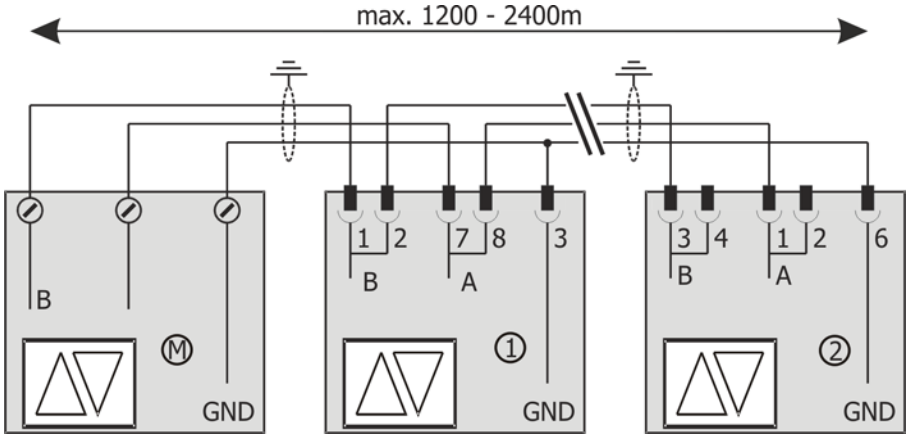


The active termination is only allowed once on each branch. The bus termination via an external circuit and via DIP switch at the same time is not allowed.

Pay attention to the ground wiring. This will protect the communication bus against high noise level.

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

Example of wiring with different CM-485 modules:



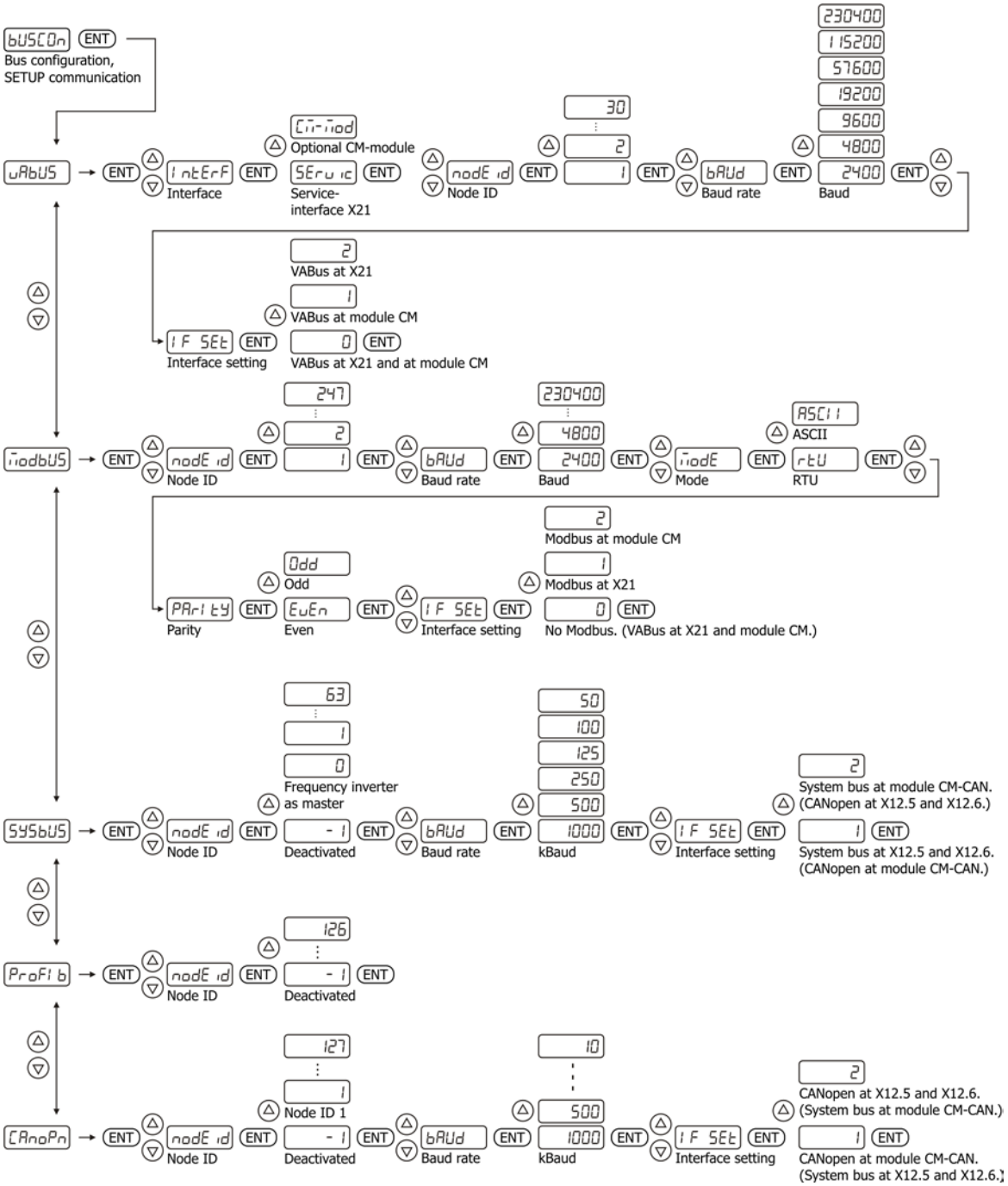
M	Master (i.e. PC)			Termination ON
1	Inverter 1	CM-485 DB9	9-pin D-Sub	Termination OFF
2	Inverter 2	CM-485T	7-pin terminal socket	Termination ON

5.3 Commissioning via the Operator Panel

A communication interface can be set up in the "Setup" menu of the Operator Panel. Further communication parameters can be set in the "Para" menu.

5.3.1 Menu for setting up the Communication

The communication interface can be set up quickly and simple via the Operator Panel.



5.3.2 Select the Protocol

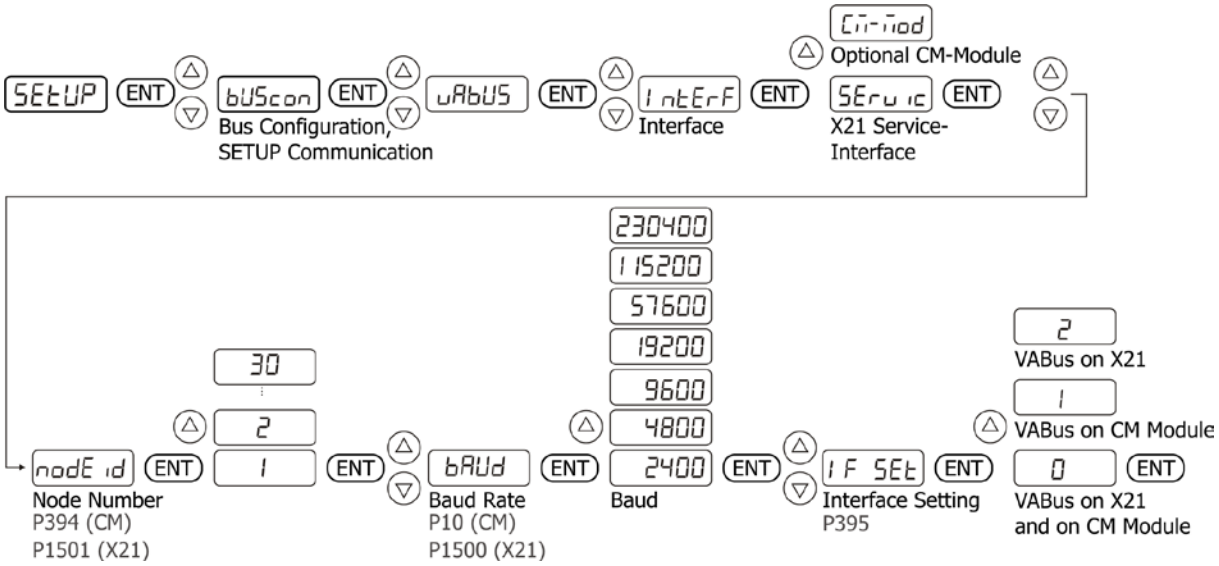
- Select VABus.

	Display
Select the "Setup" menu using the arrow keys.	SEtUP
	ENT
Using the arrow keys select:	▲ ▼
Setting up a Communication Interface (Bus Configuration)	buSCOn ENT
Select a protocol using the arrow keys:	▲ ▼
CANopen	CAnoPn
Profibus[4]	Pr0FIb
Systembus	SYSbUS
Modbus	ModbUS
VABus	uAbUS
	ENT

[4] The selection is only possible if an optional CM-PDPV1 Communication Module is installed.

5.3.3 Set the Communication Parameters

Parameter		Display
	Select the interface that is to be parameterized (X21 Service-Interface or Communication Module).	InterF
	– Select the X21 Service-Interface for the VABus-Communication. Or:	SErvic
	– Select an optional CM-232 or CM-485 Communication Module for the VABus-Communication. The selection will only be displayed, if a communication module has been installed.	CM-mod
394	Node Number (CM: VABus NodeID). An optional CM-232 or CM-485 Communication Module was selected.	nodE id
1501	Node Number (X21: VABus Node-ID). The X21 Service-Interface was selected.	nodE id
10	CM: VABus Baud Rate. An optional CM-232 or CM-485 Communication Module was selected.	bAUd
1500	X21: VABus Baud Rate. The X21 Service-Interface was selected.	bAUd
395	Interface Setting Protocol (CM / X21).	IF SEt
	– Select the VABus protocol for the X21 Service-Interface Or:	2
	– Select the VABus protocol for an optional CM-232 or CM-485 Communication Module Or:	1
	– Select the VABus protocol for the X21 Service-Interface and for an optional CM-232 or CM-485 Communication Module.	0



5.4 Set the Protocol for X21-Connection and Communication Module

- **395 Protocol (CM / X21)**

With Parameter *Protocol (CM / X21)* **395**, the communication protocol can be selected for an optional Communication Module (CM) and the X21-Connection.

Protocol (CM/X21) **395** **(CM / X21)**	**Function**
0 - CM: VABus / X21: VABus	The slot for an optional Communication Module and the X21-Connection (RJ45) are set to the VABus communication protocol. Factory setting.
1 - CM: VABus / X21: Modbus	The slot for an optional Communication Module is set to the VABus communication protocol. The X21-Connection (RJ45) is set to the Modbus communication protocol.
2 - CM: Modbus / X21: VABus	The slot for an optional Communication Module is set to the Modbus communication protocol. The X21-Connection (RJ45) is set to the VABus communication protocol.

6 VABus

The VABus protocol can be used via a fitting CM module or the onboard X21 connection (RJ45)

6.1 VABus on the X21-Connection

- **1500 X21: VABus Baud rate**

With Parameter *X21: VABus Baud rate* **1500** the transfer rate of the VABus communication can be set. The setting applies to the X21-Connection. Parameter *Protocol (CM / X21)* **395** must be set to "0 - CM: VABus / X21: VABus" or "2 - CM: Modbus / X21: VABus".

VABus-X21 Baud rate **1500**		**Function**	**max. Line Length**
1 –	2400 Baud	Transfer rate 2400 Baud	30 m
2 –	4800 Baud	Transfer rate 4800 Baud	30 m
3 –	9600 Baud	Transfer rate 9600 Baud	30 m
4 –	19200 Baud	Transfer rate 19200 Baud	30 m
5 –	57600 Baud	Transfer rate 57600 Baud	10 m
6 –	115200 Baud	Transfer rate 115200 Baud	10 m
7 –	230400 Baud	Transfer rate 230400 Baud	10 m

Attention!
Changes to the baud rate are effective immediately. A restart of the frequency inverter is not required.

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

- **1501 X21: VABus Node-ID**

With Parameter *X21: VABus Node-ID* **1501** the node address for the VABus communication can be set. The setting applies to the X21-Connection. Parameter *Protocol (CM / X21)* **395** must be set to"0 - CM: VABus / X21: VABus" or "2 - CM: Modbus / X21: VABus".

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
1501	VABus-X21 Node-ID	1	30	1

- **1502 X21: VABus Watchdog Timer**

The communication can be monitored. If the communication fails, then no data or incorrect data will be transferred. This state will be detected by the Communication Watchdog.

The Watchdog-Function monitors the time within which no correct communication occurs. This time can be set with Parameter *X21: VABus Watchdog Timer* **1502**. The set value is the time in seconds within which at least one correct data exchange must occur.

If the set monitoring time is reached the frequency inverter generates the error F2010.

The setting applies to the X21-Connection. Parameter *Protocol (CM / X21)* **395** must be set to "0 - CM: VABus / X21: VABus" or "2 - CM: Modbus / X21: VABus".

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
1502	VABus-X21 Watchdog Timer	0 s	10000 s	0 s

If the parameter is set to zero (factory setting), then monitoring is switched off.

6.2 VABus on the optional Communication Module

- **10 CM: VABus Baud Rate**

With Parameter *CM: VABus Baud Rate* **10** the transfer rate of the VABus communication can be set. The setting applies to the slot for an optional Communication Module. Parameter *Protocol (CM / X21)* **395** must be set to "0 - CM: VABus / X21: VABus" or "1 - CM: VABus / X21: Modbus".

CM: VABus Baud Rate **10**		Function	max. Line Length
1 –	2400 Baud	Transfer rate 2400 Baud	30 m
2 –	4800 Baud	Transfer rate 4800 Baud	30 m
3 –	9600 Baud	Transfer rate 9600 Baud	30 m
4 –	19200 Baud	Transfer rate 19200 Baud	30 m
5 –	57600 Baud	Transfer rate 57600 Baud	10 m
6 –	115200 Baud	Transfer rate 115200 Baud	10 m
7 –	230400 Baud	Transfer rate 230400 Baud	10 m

Parameter *CM: VABus Baud Rate* **10** is only available if a communication module is installed.

Caution!
Changes to the baud rate are effective immediately. A restart of the frequency inverter is not required.

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

- **394 CM: VABus NodeID**

With Parameter *CM: VABus NodeID* **394** the node address for the VABus communication can be set. The setting applies to the slot for an optional Communication Module. Parameter *Protocol (CM / X21)* **395** must be set to "0 – VABus / VABus" or "1 – VABus / Modbus".

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
394	CM: VABus NodeID	1	30	1

CM: Communication Module

Parameter *CM: VABus NodeID* **394** is only available, if a communication module is installed.

- **413 CM: VABus Watchdog Timer**

The communication can be monitored. If the communication fails, then no data or incorrect data will be transferred. This state will be detected by the Communication Watchdog.

The Watchdog-Function monitors the time, within which no correct communication occurs. This time can be set with Parameter *CM: VABus Watchdog Timer* **413**. The set value is the time in seconds within which at least one correct data exchange must occur.

If the set monitoring time is reached the frequency inverter generates the error F2011.

The setting applies to the slot for an optional Communication Module. Parameter *Protocol (CM/X21)* **395** must be set to "0 - VABus/VABus" or "1 - VABus/Modbus".

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
413	CM: VABus Watchdog Timer	0 s	10000 s	0 s

CM: Communication Module

If the parameter is set to zero (factory setting), then monitoring is switched off.

Parameter *CM: VABus Watchdog Timer* **413** is only available if a Communication Module is installed.

7 Protocol

The VABus protocol is the standard protocol of BONFIGLIOLI VECTRON. It defines and describes the communication via the RS232 / RS485 serial interfaces.

By default, the slot for an optional Communication Module and the X21-Connection are set to the VABus protocol. The setting can be changed via Parameter *Protocol (CM/X21)* **395**. See Chapter 5.4 "Set the Protocol for X21-Connection and Communication Modul".

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

The transmission protocol corresponds to the ISO standard 1745 for code-based information transfer and applies to the X21-Connection and the CM232 and CM-485 Communication Modules.

Two types of request are used:

- Send Request (Enquiry Telegram) for the request for reading parameters in the frequency inverter by the bus master.
- Setting Request (Select Telegram) for handing over parameter values or parameter settings to the frequency inverter by the bus master.

7.1 Character Format

The characters are based on 7-bit code according to DIN 66003 and consists of:

- 1 start bit
- 7 information bits (7 data bits B1… B7) corresponds to dec. value 0 … 127
- 1 parity bit (even parity)
- 1 stop bit

Character format:

Start	B1	B2	B3	B4	B5	B6	B7	Parity	Stop

The start bit is followed by the least significant data bit.

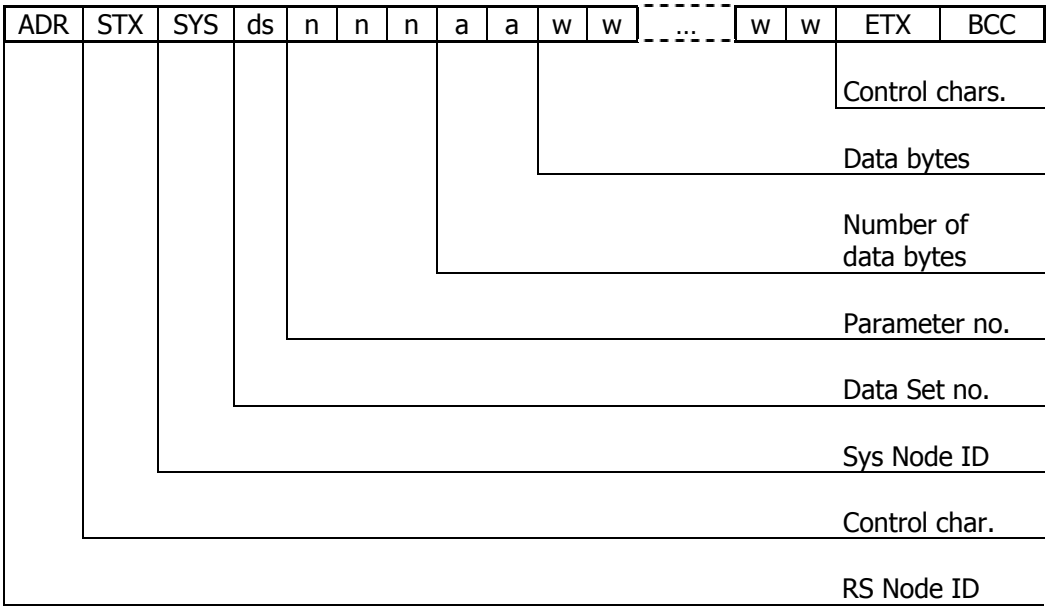
7.2 Telegram Types

The telegram setup must be complied with to ensure the correct communication to the device.

7.2.1 Used Symbols

Control characters and data are transmitted in the sent data telegrams. The information is always represented in ASCII or HEX-ASCII data format (except for the representation of the checksum).

Structure of a data telegram



The following table shows the symbols and data formats used.

Characters in Data Telegram			
Character	Function		
EOT	Control character End_Of_Transmission		
ADR	Address of the selected frequency inverter (Node-ID + 0x30). See Chapter 7.2.5 "Address Representation".		
STX	Control character Start_of_Text		
SYS	System Node-ID (Node-ID + 0x40). See Chapter 7.2.7 "Systembus Node-ID".		
ds	Data Set number	(0, 1, 2, 3 ... 9	[5]
nnn	Parameter number	(000 ... F99)	
aa	No. of subsequent data bytes	(01 ... 99)	
www...www	Data bytes	(0 ... F)	[6]
ETX	Control character End_of_Text		
ENQ	Control character Enquiry		
BCC	BCC Binary-Checksum, any ASCII character. See Chapter 7.2.12. "Binary Checksum (BCC)".		
ACK	Control character Acknowledge (positive acknowledgement)		
NAK	Control character Negative_Acknowledge (negative acknowledgement)		

[5] represented as ASCII decimal numbers
[6] represented as ASCII-HEX numbers

7.2.2 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	**Type**	**No. of Data Bytes "w"**	**Value Range**	**No. of Bits**
uInt	unsigned Integer	04	0 … 65535	16
Int	Integer	04	-32768 ... +37767	16
Long	Long	08	-2^{31} ... $+2^{31}-1$	32
String	char. string	variable, up to 99	-	variable

Parameter values with decimal places are transferred without the 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 inverter. In this way it is made sure that the sent parameter values are processed with the correct number of decimal places.

Example: Frequency value with data type Long:

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

⟹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 bytes are transferred ("wwww").

⟹0067

7.2.3 Send Request / Enquiry Telegram

Via the enquiry telegram of the bus master, the frequency inverter is requested to send the data content of the relevant parameter. In the enquiry response telegram, the frequency inverter sends the requested data to the bus master. The master completes the transmission with EOT.

Bus Master ⟹ Frequency Inverter

EOT	ADR	SYS	ds	n	n	n	ENQ

Frequency Inverter ⟹ Bus Master

ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	…	…	w	w	w	ETX	BCC

or in the case of an error:

ADR	NAK

Bus Master ⟹ Frequency Inverter

EOT

If no response from the frequency inverter is received within an adjustable response time (see chapter 7.4, "Monitoring Function (Timing / Watchdog)"), or if the frequency inverter returns incorrect data, the enquiry 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 transmission failures, incorrect data or an incorrect string.

Attention!
After a NAK the error register *VABus SST-Error-Register* **11** must be read out (see Chapter 7.3 "Telegram Check / Error Acknowledgement").

7.2.4 Setting Request / Select Telegram

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

Bus Master ⟹ Frequency Inverter

EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	...	w	w	w	ETX	BCC

Frequency Inverter ⟹ Bus Master

With ACK, the frequency inverter acknowledges that a valid string was received.

ADR	ACK

Or in the case of an error:

ADR	NAK

Bus Master ⟹ Frequency Inverter

EOT

Attention!
After a NAK the error register *VABus SST Error Register* **11** must be read out (see Chapter 7.3 "Telegram Check / Error Acknowledgement").
Broadcast transmissions to address 32 are not acknowledged with ACK, NAK and EOT.
In general, the bus master sends unconfirmed data telegrams in the case of broadcast transmissions.

7.2.5 Address Representation

Up to 30 frequency inverters can be used on an RS485 bus. These are assigned addresses 1...30.
Via address 32, all clients connected can be addressed simultaneously. Address 32 is also referred to as the Broadcast Address.

Attention!
After a transmission to the Broadcast Address 32, there is no response (ACK or NAK) from the frequency inverters.

Address Coding					
Num. Address	**ASCII Char**	**Hex. Address**	**Num. Address**	**ASCII Char**	**Hex. Address**
1	A	41	16	P	50
2	B	42	17	Q	51
3	C	43	18	R	52
4	D	44	19	S	53
5	E	45	20	T	54
6	F	46	21	U	55
7	G	47	22	V	56
8	H	48	23	W	57
9	I	49	24	X	58
10	J	4A	25	Y	59
11	K	4B	26	Z	5A
12	L	4C	27	[	5B
13	M	4D	28	\	5C
14	N	4E	29	]	5D
15	O	4F	30	^	5E
			32[7]	`	60

7.2.6 Control Characters

The following control characters are used:

Control Characters		
Control Character	Name	HEX Value
EOT	End_Of_Transmission	04
ENQ	Enquiry	05
STX	Start_Of_Text	02
ETX	End_Of_Text	03
ACK	Acknowledge	06
NAK	Negative_Acknowledge	15

7.2.7 Systembus Node-ID

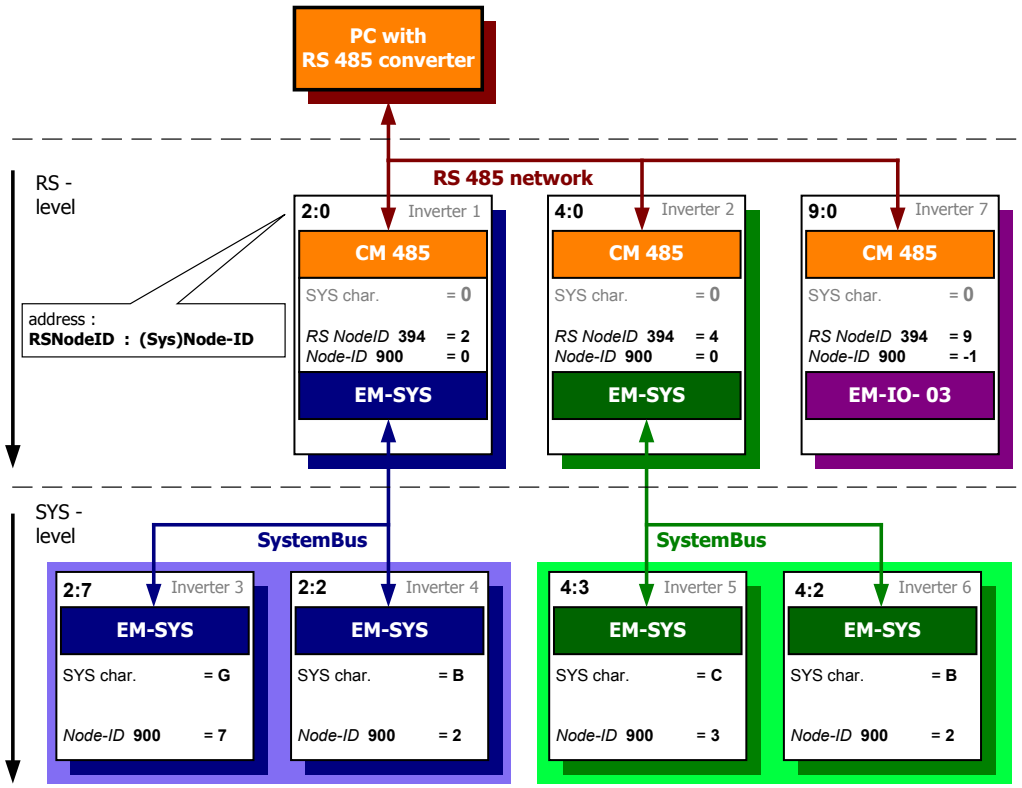
With the Systembus *Node-ID* **900** the master communicates with inverters which are connected by a network system. If no network is present or the master communicates directly with the RS485-master inverter the SYS character is always zero (**0x30**). The Systembus *Node-ID* **900** has the value range of 0 to 63.

Node-ID 900	Function	SYS Char
-1	No Systembus connected to the inverter.	„-1" = 0xFFFF
0	The inverter is the Systembus master.	„0" = 0x30
1 ... 63	The inverter is a Systembus slave with the indicated ID.	0x41 ... 0x7F

If the *Node-ID* **900** is unequal to zero the SYS character is calculated by the following formula:
SYS Char = (char) (Sys Node-ID Nr + 0x40)

For example the *Node-ID* **900** of 7 gives the char 0x47 = "G".

[7] Broadcast Address only from the Master



The

Addresses in a Systembus branch must be assigned clearly. The RS485 system can access to several Systembus branches so that identical Systembus addresses are possible in the network, but only via different superior RS485 network subscribers.

7.2.8 Data Set

The data set limits change depending on the information direction. The data set number is transferred as an ASCII_character:

Data Set			
Directions	**Number**	**Char**	**Target**
Master -> Inverter	0 – 4	0x30 .. 0x34	Inverter EEPROM
Master -> Inverter	5 – 9	0x35 .. 0x39	Inverter RAM
Inverter-> Master	0 – 4	0x30 .. 0x34	-

7.2.9 Parameter Number

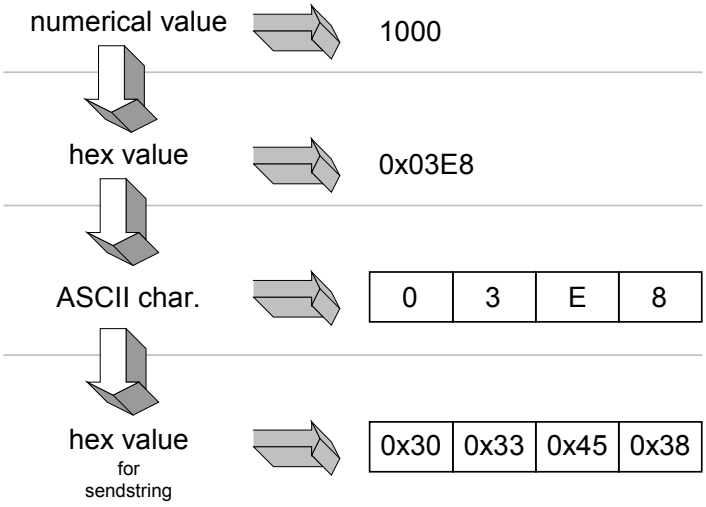
The parameter number is always transferred as 3 ASCII characters. If the parameter number is greater than 999, the first position (hundred) is converted to "A" to "F".

Parameter Number	
Number	**In the Data Telegram**
0 – 999	"000" .. "999"
1000 – 1099	"A00" .. "A99"
1100 – 1199	"B00" .. "B99"
...	...
1500 – 1599	"F00" .. "F99"

7.2.10 Data Bytes

Numerical values are represented by ASCII-HEX characters. The value is first of all converted to HEX notation and then, for each position transferred to ASCII charters.

Example:



7.2.11 Control Char ETX

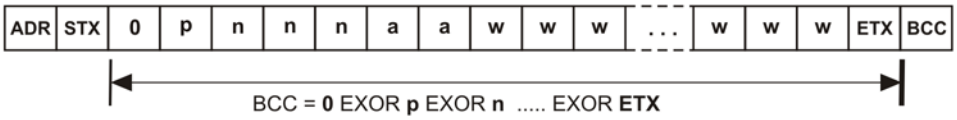
Each data frame with parameter values is finished via the EXT character (0x03).

7.2.12 Binary Checksum (BCC)

The binary checksum (BCC) is made up of a byte which contains the ExOR operation of all bytes between STX (exclusive) and ETX (inclusive).

Only telegrams with parameter values are extended by the binary checksum. Enquiry, ACK and NAK telegrams do not have a checksum.

Send Request



Setting Request

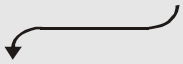
Example: (see also Chapter 9.2 "Data Type Int (value range -32768 ... +32767)"

SYS Node-ID = 0 = 0x30
Data Set = 2 = 0x32
Parameter Number = 520 = 0x35 0x32 0x30
No. of Bytes (Int) = 04 = 0x30 x034
Value = 1000 = 0x30 0x33 0x45 0x38

	SYS	ds	n	n	n	a	a	w	w	w	w	ETX
ASCII	0	2	5	2	0	0	4	0	3	E	8	-
Hex-Values	30	32	35	32	30	30	34	30	33	45	38	03

ExOR function over all characters in the data frame :

0x30 ^0x32 = 0x02



0x02 ^0x35 = 0x37
0x37 ^0x32 = 0x05
0x05 ^0x30 = 0x35
0x35 ^0x30 = 0x05
0x05 ^0x34 = 0x31
0x31 ^0x30 = 0x01
0x01 ^0x33 = 0x32
0x32 ^0x45 = 0x77
0x77 ^0x38 = 0x4F
0x4F ^0x03 = 0x4C

The BCC is calculated as character "**L"** = 0x4C.

Example of ExOR operation for the first two characters :

```
0011 0000= 0x30
0011 0010= 0x32
--- EXOR-------
0000 0010= 0x02
```

7.3 Telegram Check / Error Acknowledgement

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:

- incorrect telegram structure
- incorrect control character
- wrong address
- telegram addressed to address 32 (Broadcast); in this case the frequency inverter does not reply

NAK
See Chapter 13.1 "Warning Messages".

- **11 VABus SST-Error-Register**

If a transmission (enquiry or select telegram) is answered by the frequency inverter with NAK, the error register *VABus SST-Error-Register* **11** of the interface must be read out before a new **select telegram** is sent.

VABus SST-Error-Register **11**	
Error No.	**Meaning**
0	no error
1	inadmissible parameter value
2	inadmissible data set
3	parameter not readable (write-only)
4	parameter not writeable (read-only)
5	EEPROM read error
6	EEPROM write error
7	EEPROM checksum error
8	parameter cannot be written while the drive is running
9	values of the data sets differ from one another
10	wrong parameter type
11	unknown parameter
12	checksum error in received telegram
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	Systembus client not reachable.

When the error register *VABus SST-Error-Register* **11** is read out, it is cleared at the same time.

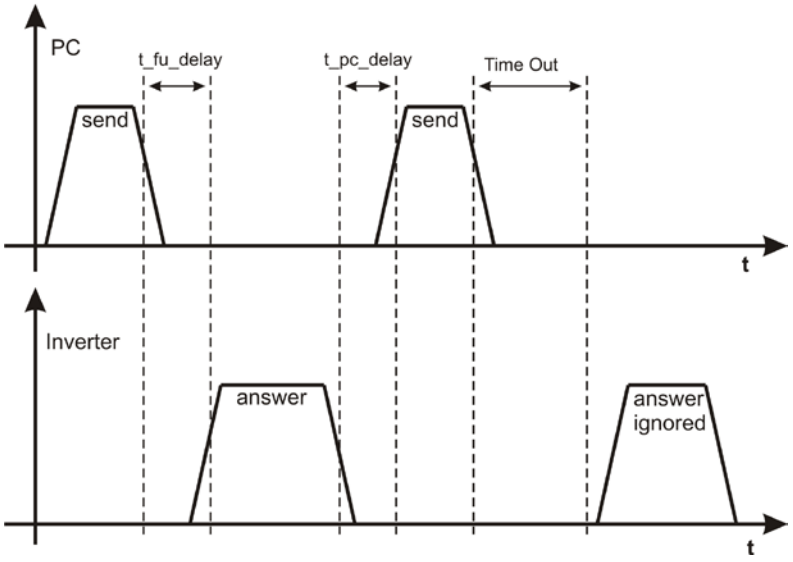
Attention!
The frequency inverter will not accept a new select telegram until the error register has been read. Enquiry telegrams will be accepted and answered.

7.4 Monitoring Function (Timing / Watchdog)

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

After a frequency inverter has sent a telegram, a waiting time of 2 ms must be kept (t_pc_delay), which the frequency inverter requires in order to switch off the RS485-Transmitter. The bus master may not send a new telegram until this time has elapsed.

The frequency inverter replies 1 ms after receipt of a telegram (t_fu_delay) at the earliest. This means that the bus master must have switched off its RS485-Transmitter after 1 ms at the latest.



Attention!
If the CPU utilization is high (> 90%), then the response time can be more than 500 ms.

Note:
The specified times are valid for operation with RS485 and RS232.

If the frequency inverter has not received a character after 500 ms, it rejects the character string received so far and waits for a new transmission.

If the frequency inverter is operated via the serial interface (RS232, RS485), it may be important to monitor the presence of the communication line. For example it may be that the frequency inverter is switched on/off in Remote Mode, or it only receives its reference value cyclically via the serial interface. If the communication fails, no or faulty data are transmitted. This is recognized by the communication watchdog.

The watchdog function monitors the time in which no correct communication takes place.

Interface	Parameter	See Chapter
X21-Interface	*X21: VABus Watchdog Timer* **1502**	6.1 "VABus on the X21-Connection"
optional Communication Module	*CM: VABus Watchdog Timer* **413**	6.2 "VABus on the optional Communication Module"

7.5 Block Access

If a number of parameters are to be transmitted regularly block by block, a block transmission can be carried out using the pseudo parameter described here. Since this type of block transmission only requires one communication overhead it can be carried out faster and may be easier to implement. The error evaluation and diagnosis for this block access is more difficult than for a separate parameter access.

The block definition has to be written in the parameter *Block definition* **017** before a block transmission can be carried out. (This block definition is only saved until the next Reset.) A block can then be written on the parameter *Write block* **018** and/or read from the parameter *Read block* **019**. Only parameters of the type word and/or double word can be transferred during block transmission. The check sum is calculated (like a separate parameter access) from SYS and ETX (both inclusively). Each transmission is responded by the frequency inverter with ACK or NAK.

Parameter *Block definition* **17**
The block definition is a string containing the parameter numbers of the parameters in the block as five-digit decimal figures in succession.
The digits have the following functions:
1. Digit S: Systembus node

2. Digit d: Data set number
Digit 3 to 5: Parameter number
The block can have a maximum string length of 80 characters.

SdnnnSdnnn ... Sdnnn

Parameter *Write Block* **18**
Parameter *Read Block* **19**
The data block is a string containing the values of the parameters in an ASCII-Hex form in succession.

The maximum string length is 80 characters, enabling the transmission of blocks of up to 20 parameters of the type "word" (each with 4 Hex digits). If the block contains parameters of the type double word (each with 8 Hex digits) the number of parameters which can be transmitted in a block is reduced accordingly.

Examples of a block transfer

Read parameters *Stator frequency* **210** (FS), *R.m.s current* **211** (I RMS) and *Active power* **213** (PW), each from data set 0.

Parameter string for *Write Parameter* **017**: „002100021100213"
Parameter string for *Read Parameter* **019**: „00002A5D00660028"

Set Parameter 017 Master ⇨ Frequency Inverter

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	w	w	w	w	w	ETX	BCC
ASCII	♦	A	☻	0	0	0	1	7	1	5	0	0	2	1	0	0	0	2	1	1	0	0	2	1	3	♥	
Hex-Values	04	41	02	30	30	30	31	37	31	35	30	30	32	31	30	30	30	32	31	31	30	30	32	31	33	♥	00

Enquiry Telegram Master ⇨ Frequency Inverter

	EOT	ADR	SYS	ds	n	n	n	ENQ
ASCII	♦	A	0	0	0	1	9	♣
Hex-Values	04	41	30	30	30	31	39	05

Response Frequency Inverter ⇨ Master

	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	w	w	w	w	w	w	w	ETX	BCC
ASCII	A	☻	0	0	0	1	9	1	6	0	0	0	0	2	A	5	D	0	0	6	6	0	0	2	8	♥	4
Hex-Values	41	02	30	30	30	31	39	31	36	30	30	30	30	32	41	35	44	30	30	36	36	30	30	32	38	♥	34

Parameter		**Data Type**	**Hex-Value**	**Decimal**	**Result**
210	Stator frequency	Double word = 8 Hex-digits	$00002A5D_{hex}$	10845_{dec}	108,45 Hz
211	R.m.s current	Word = 4 Hex-digits	0066_{hex}	102_{dec}	10,2 A
213	Active power	Word= 4 Hex-digits	0028_{hex}	40_{dec}	4,0 kW

Write the parameters *Fixed Frequency 2* **481** (FF2) and *Fixed frequency 3* **482** (FF3) in data set 1.

Values:
FF2 (double word = 8 hex-digits) = 123.50 Hz, $12350_{dec} = 0000303E_{hex}$
FF3 (double word = 8 hex-digits) = 43.45 Hz, $4345_{dec} = 000010F9_{hex}$

Write parameter 017: "0148101482"

Write parameter 018: "0000303E000010F9"

Write Parameter 017 Master ⇨ Frequency Inverter

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	w	w	w	ETX	BCC
ASCII	♦	A	☻	0	0	0	1	7	1	0	0	1	4	8	1	0	1	4	8	2	♥	5
Hex-Values	04	41	02	30	30	30	31	37	31	30	30	31	34	38	31	30	31	34	38	32	♥	37

Write Parameter 018 Master ⇨ Frequency Inverter

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	w	w	w	w	w	w	w	ETX	BCC
ASCII	♦	A	☻	0	0	0	1	8	1	6	0	0	0	0	3	0	3	E	0	0	0	0	1	0	F	9	♥	6
Hex-Values	04	41	02	30	30	30	31	38	31	36	30	30	30	30	33	30	33	44	30	30	30	30	31	30	45	39	♥	36

Note:
For the read access of data set dependent parameters BONFIGLIOLI VECTRON recommends reading the parameters separately for each data set.

If a data set-dependent parameter with data set 0 (= all data sets) is read and the values in the data sets are different from each other the response of the frequency inverter must be evaluated accordingly. A failed operation can be recognized by the number of bytes = 99.

With block transmission, parameters with data type "string" cannot be transmitted.

8 Handling of Data Sets / Cyclic Writing

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

There are parameters the values of which exist once (data set 0) as well as parameters the values of which exist four times (data set 1...4). These are used for data set change-over.

If parameters which exist four times in the data sets are set to data set = 0, all four data sets are 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. If this is not the case, error 9 = "different values in data sets" is signaled via the error register *VABus SST Error Register* **11**. In this case, you must read out each data set separately for the relevant parameter (see chapter 7.3 "Telegram Check / Error Acknowledgement").

New setting requests (select telegrams) will be blocked by the error register *VABus SST Error Register* **11**. For this reason, the error register must be read out, i.e. acknowledged, before a new select telegram can be sent.

Regardless of the signal status of the error register, reading access (enquiry telegrams) is still possible.

The values are entered into the EEPROM automatically on the controller. If values are to be written cyclically with a high repetition rate, there must be no entry into the EEPROM, as it only has a limited number of admissible writing cycles (about 1 million cycles).

Caution!

If the number of admissible writing cycles is exceeded, the EEPROM is destroyed.

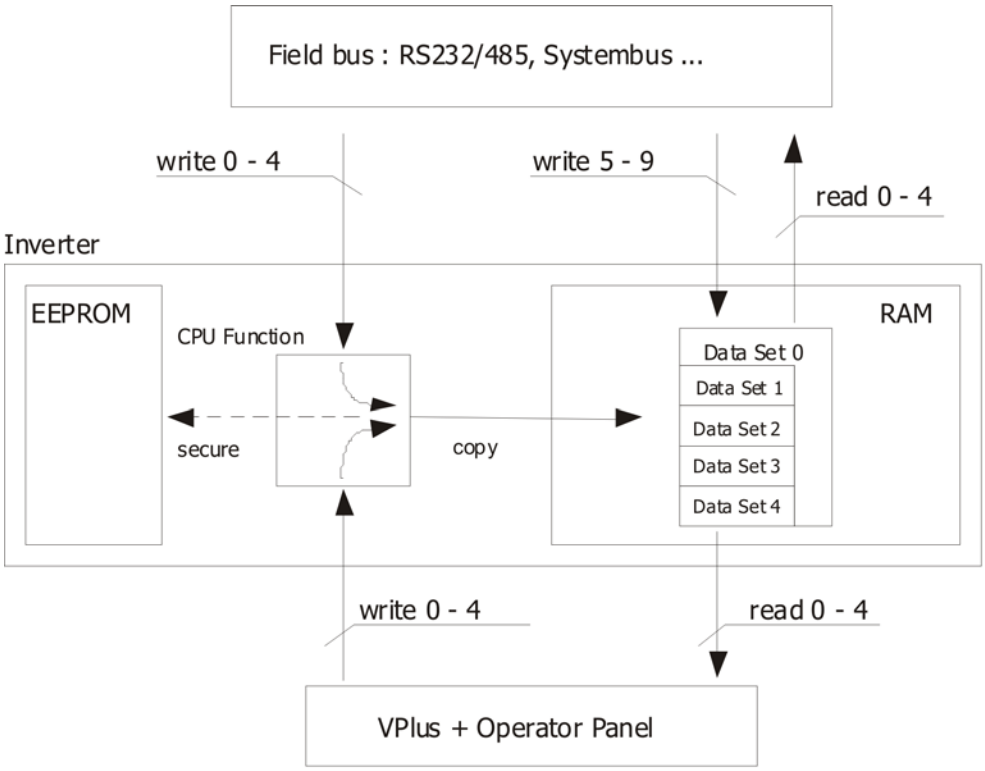
In order to avoid the destruction of the EEPROM, data which are to be written cyclically can be entered in the RAM exclusively without a writing cycle on the EEPROM. In this case, the data are volatile, i.e. they are lost when the supply voltage is switched off (Mains Off). They must be written into the RAM again after the restart (Mains On).

The RAM writing operation is activated by increasing the number of the target data set by five.

Exceptions are the parameters *Control Word* **410**, *Reference Frequency RAM* **484** and *Reference Percentage RAM* **524**. These parameters will be written into the RAM although their addresses are always 0.

Access to the Data Sets of the Frequency Inverter

Parameter	EEPROM	RAM
Data Set 0	0	5
Data Set 1	1	6
Data Set 2	2	7
Data Set 3	3	8
Data Set 4	4	9


Field bus : RS232/485, Systembus ...
write 0 - 4
write 5 - 9
read 0 - 4
Inverter
EEPROM
CPU Function
RAM
Data Set 0
Data Set 1
Data Set 2
Data Set 3
Data Set 4
secure
copy
write 0 - 4
read 0 - 4
VPlus + Operator Panel

9 Example Telegrams

9.1 Data Type uInt (value range 0 ...65535)

Example 1:
Reading of parameter *Rated Speed* **372** in data set 2 from the frequency inverter with address 1.

Enquiry Telegram Master ⟹ Frequency Inverter

	EOT	ADR	SYS	ds	n	n	n	ENQ
ASCII	♦	A	0	2	3	7	2	♣
Hex-Values	04	41	30	32	33	37	32	05

Reply Frequency Inverter ⟹ Master

	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	ETX	BCC
ASCII	A	☻	0	2	3	7	2	0	4	0	5	6	E	♥	E
Hex-Values	41	02	30	32	33	37	32	30	34	30	35	36	45	03	45

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:
Writing of parameter *Rated Mech. Power* **376** in data set 4 to the frequency inverter with address 3.

The rated mechanical power is to be set to 1.5 kW. Parameter *Rated Mech. Power* **376** has one decimal place.
Thus the value to be sent is 15, hexadecimal 0x000F.

Select Telegram Master ⟹ Frequency Inverter

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	ETX	BCC
ASCII	♦	C	☻	0	4	3	7	6	0	4	0	0	0	F	♥	G
Hex-Values	04	43	02	30	34	33	37	36	30	34	30	30	30	46	03	47

Reply Frequency Inverter ⟹ Master

	ADR	ACK
ASCII	C	♠
Hex-Values	43	06

In the case of an error, the reply would have resulted a NAK.

	ADR	NAK
ASCII	C	§
Hex-Values	43	15

9.2 Data Type Int (value range -32768 ... +32767)

Example 1:
Reading of parameter *Fixed Percentage 1* **520** in data set 2 from the frequency inverter with address 10.

Enquiry Telegram Master ⇨ Frequency Inverter

	EOT	ADR	SYS	Ds	n	n	n	ENQ
ASCII	♦	J	0	2	5	2	0	♣
Hex-Values	04	4A	30	32	35	32	30	05

Reply Frequency Inverter ⇨ Master

	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	ETX	BCC
ASCII	J	☻	0	2	5	2	0	0	4	0	3	E	8	♥	L
Hex-Values	4A	02	30	32	35	32	30	30	34	30	33	45	38	03	4C

The sent hexadecimal value is 0x03E8 = decimal 1000. Parameter *Fixed Percentage 1* **520** has two decimal places.
Thus the reference percentage 1 = 10.00 %.

Example 2:
Writing of parameter *Fixed Percentage 4* **376** in data set 0 to the frequency inverter with address 30.

The reference percentage 4 is to be set to 70.05 %. Parameter *Fixed Percentage 4* **523** has two decimal places.
Thus the value to be sent is 7005, hexadecimal 0x1B5D.

Select Telegram Master ⇨ Frequency Inverter

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	ETX	BCC
ASCII	♦	^	☻	0	0	5	2	3	0	4	1	B	5	D	♥	1
Hex-Values	04	5E	02	30	30	35	32	33	30	34	31	42	35	44	03	31

Reply Frequency Inverter ⇨ Master

	ADR	ACK
ASCII	^	♠
Hex-Values	5E	06

In the case of an error, the reply would have resulted in a NAK.

	ADR	NAK
ASCII	^	§
Hex-Values	5E	15

9.3 Data Type Long (value range -2^{31} ... +2^{31}-1)

Example 1:
Reading of parameter *Fixed Frequency 2* **481** in data set 0 from the frequency inverter with address 1.

Enquiry Telegram Master ⇨ Frequency Inverter

	EOT	ADR	SYS	ds	n	n	n	ENQ
ASCII	♦	A	0	0	4	8	1	♣
Hex-Values	04	41	30	30	34	38	31	05

Reply Frequency Inverter ⇨ Master

	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	ETX	BCC
ASCII	A	☻	0	0	4	8	1	0	8	0	0	0	0	0	3	E	8	♥	H
Hex-Values	41	02	30	30	34	38	31	30	38	30	30	30	30	30	33	45	38	03	48

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

Example 2:
Writing of parameter *Fixed Frequency 1* **480** in data set 0 to the frequency inverter with address 1.

Fixed frequency 1 is to be set to -120.00 Hz. Parameter *Fixed Frequency 1* **480** has two decimal places.
Thus the value to be sent is -12000, hexadecimal 0xFFFFD120.

Select Telegram Master ⇨ Frequency Inverter

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	w	ETX	BCC
ASCII	♦	A	☻	0	0	4	8	0	0	8	F	F	F	F	D	1	2	0	♥	@
Hex-Values	04	41	02	30	30	34	38	30	30	38	46	46	46	46	44	31	32	30	03	40

Reply Frequency Inverter ⇨ Master

	ADR	ACK
ASCII	A	♠
Hex-Values	41	06

In the case of an error, the reply would have resulted in a NAK.

	ADR	NAK
ASCII	A	§
Hex-Values	41	15

9.4 Data Type String (max. 99 characters)

Example 1:
Reading of parameter *User Name* **29** in data set 0 from the frequency inverter with address 1.

Enquiry Telegram Master ⟹ Frequency Inverter

	EOT	ADR	SYS	ds	n	n	n	ENQ
ASCII	♦	A	0	0	0	2	9	♣
Hex-Values	04	41	30	30	30	32	39	05

Reply Frequency Inverter ⟹ Master

	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	ETX	BCC
ASCII	A	☻	0	0	0	2	9	0	7	V	e	c	t	r	o	n	♥	h
Hex-Values	41	02	30	30	30	32	39	30	37	56	65	63	74	72	6F	6E	03	68

The sent string for parameter *User Name* **29** reads "Vectron".

Example 2:
Writing of parameter *User Name* **29** in data set 0 to the frequency inverter with address 1.

The user name is to be set to "Inverter_17".

	EOT	ADR	STX	SYS	ds	n	n	n	a	a	w	w	w	w	w	w	w	w	w	w	ETX	BCC
ASCII	♦	A	☻	0	0	0	2	9	1	1	**I**	**n**	**v**	**e**	**r**	**t**	**e**	**r**	**_**	**1**	**7**	♥	D
Hex-Values	04	41	02	30	30	30	32	39	31	31	49	6E	76	65	72	74	65	72	5F	31	37	03	44

Reply Frequency Inverter ⟹ Master

	ADR	ACK
ASCII	A	♠
Hex-Values	41	06

In the case of an error, the reply would have resulted in a NAK.

	ADR	NAK
ASCII	A	§
Hex-Values	41	15

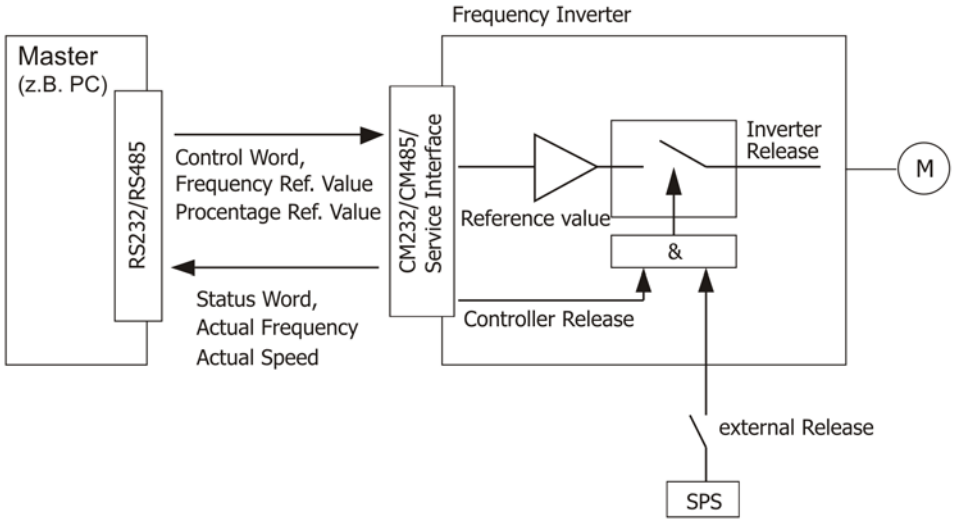
10 Control / Reference Value

- **410 Control Word**
- **411 Status Word**
- **484 Reference Frequency RAM [Hz]**
- **524 Reference Percentage RAM[%]**

The frequency inverter can be controlled completely via the serial interface. The following parameters and actual values are used for this:

Parameter		Setting			
No.	**Name/Meaning**	**Min.**	**Max.**	**Factory Setting**	**Type**
410	Control Word	0x0000	0xFFFF	-	uInt
411	Status Word	0x0000	0xFFFF	-	uInt
484	Ref. Frequency Value RAM [Hz]	-999,99	999,99	0,00	Long
524	Ref. Percentage RAM [%]	-300,00	300,00	0,00	Long

With the *Control Word* **410** (data type uInt), control commands are sent to the frequency inverter. With the *Reference Frequency RAM* **484** (data type Long [Hz]) or *Reference Percentage RAM* **524** (data type Long [%]), the reference line value is sent. Via the *Status Word* **411** (data type uInt), the status of the frequency inverter is read out.



Note:
Control Word **410**, *Reference Frequency RAM* **484** and *Reference Percentage RAM* **524** are stored in the RAM of the frequency inverter. This is generally addressed via data set 0.

- **412 Local/Remote**

The frequency inverter can be controlled with various operation modes. These operation modes can be selected with parameter *Local/Remote* **412**.

Local/Remote 412	Function
0 - Control via Contacts	The Start and Stop commands as well as the direction of rotation are set via digital signals.
1 - Control via Statemachine	The Start and Stop commands as well as the direction of rotation are controlled via the Remote Statemachine[8] of the communication interface.
2 - Control via Remote Contacts	The Start and Stop commands as well as the direction of rotation are controlled via virtual digital signals through the communication protocol.

For operation via the serial interface, settings 0, 1 and 2 are relevant. Further possible operation modes *Local/Remote* **412** are described in the frequency inverter operating instructions. These relate to the control via the Operator Panel and the control via digital signals.

Parameter *Local/Remote* **412** is data set related, i.e. by selecting a data set, you can switch over between the different operation modes.

- **414 Data Set Selection**

The data set switch-over can be carried out via control contacts at the digital inputs of the frequency inverter or via the bus. For data set change-over via the bus, parameter *Data Set Selection* **414** is used.

Parameter		Setting		
No.	**Name**	**Min.**	**Max.**	**Factory Setting**
414	Data Set Selection	0	5	0

With the default setting *Data Set Selection* **414** = 0, the data set change-over is carried out via the digital inputs.

If *Data Set Selection* **414** is set to 1, 2, 3 or 4, the selected data set is activated via the bus. At the same time, data set change-over via the digital inputs is deactivated.

If *Data Set selection* **414** = 5, then data set switching is only carried out whenever the frequency inverter is not released.

The currently selected data set can be read out with Parameter *Active Data Set* **249**. *Active data set* **249** states the activated data set with the value 1, 2, 3 or 4. This is independent of whether the data set change-over was carried out via control inputs or via *Data Set Selection* **414**.

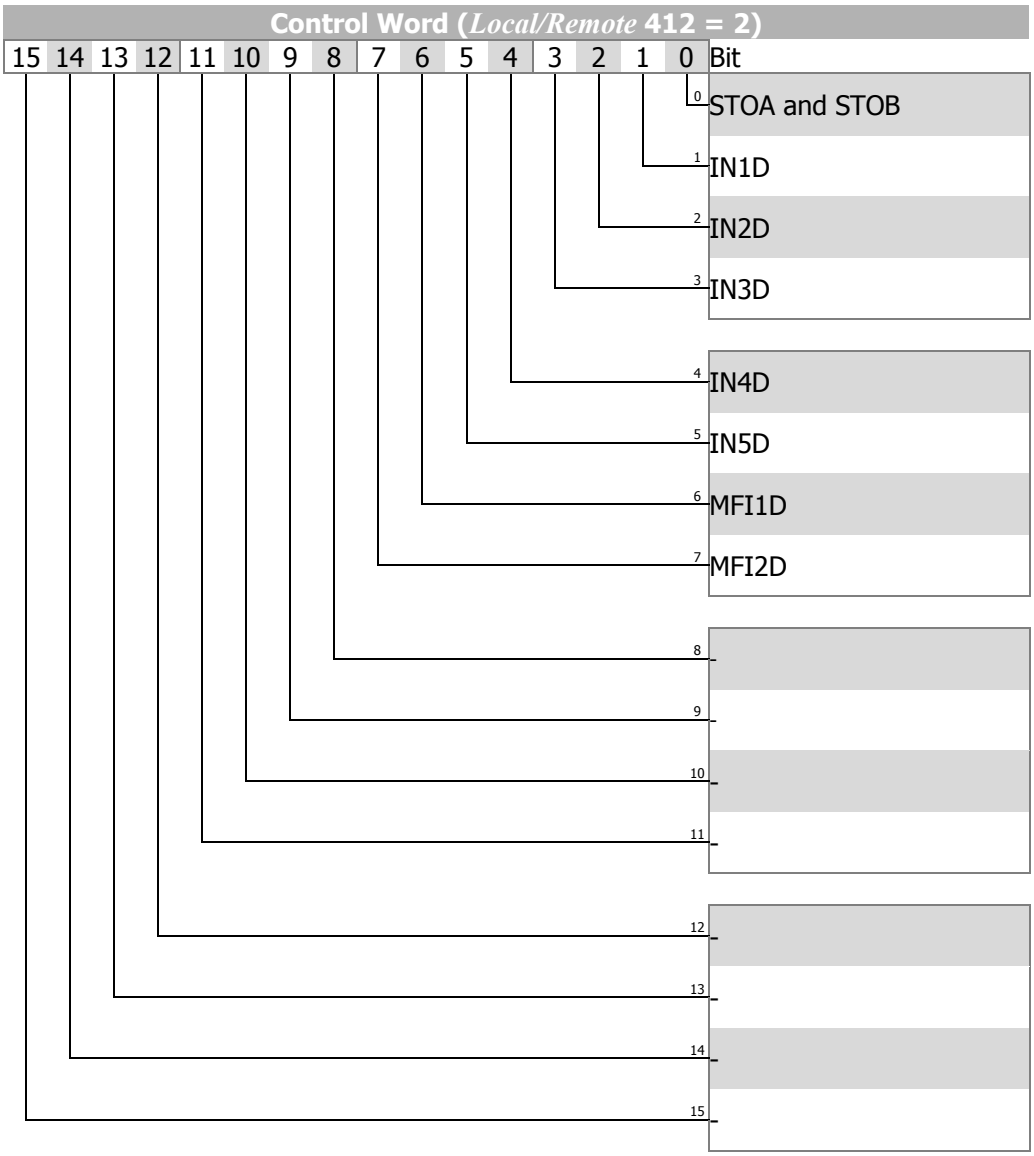
[8] Statemachine is a standardized software module within the controller of the frequency inverter. The Statemachine represents the specified operating states and control within the frequency inverter.

10.1 Control via Contacts / Remote-Contacts

In the operation mode "Control via Contacts" (*Local/Remote* **412** = 0), the frequency inverter is controlled via the digital inputs or via the multi-functional inputs that have been set to digital inputs.

In the operation mode "Control via Remote Contacts" (Parameter *Local/Remote* **412** = 2), the frequency inverter is controlled via the individual bits of the virtual digital inputs in the Control Word.

If the frequency inverter is controlled via the digital inputs, then in this operation mode control via the *Control Word* **410** does not apply.



If the operation mode "Control via Remote Contacts" is used, then the Controller Release "STOA+STOB" must be switched on and bit 0 of the Control Word must be set, in order to start the drive.

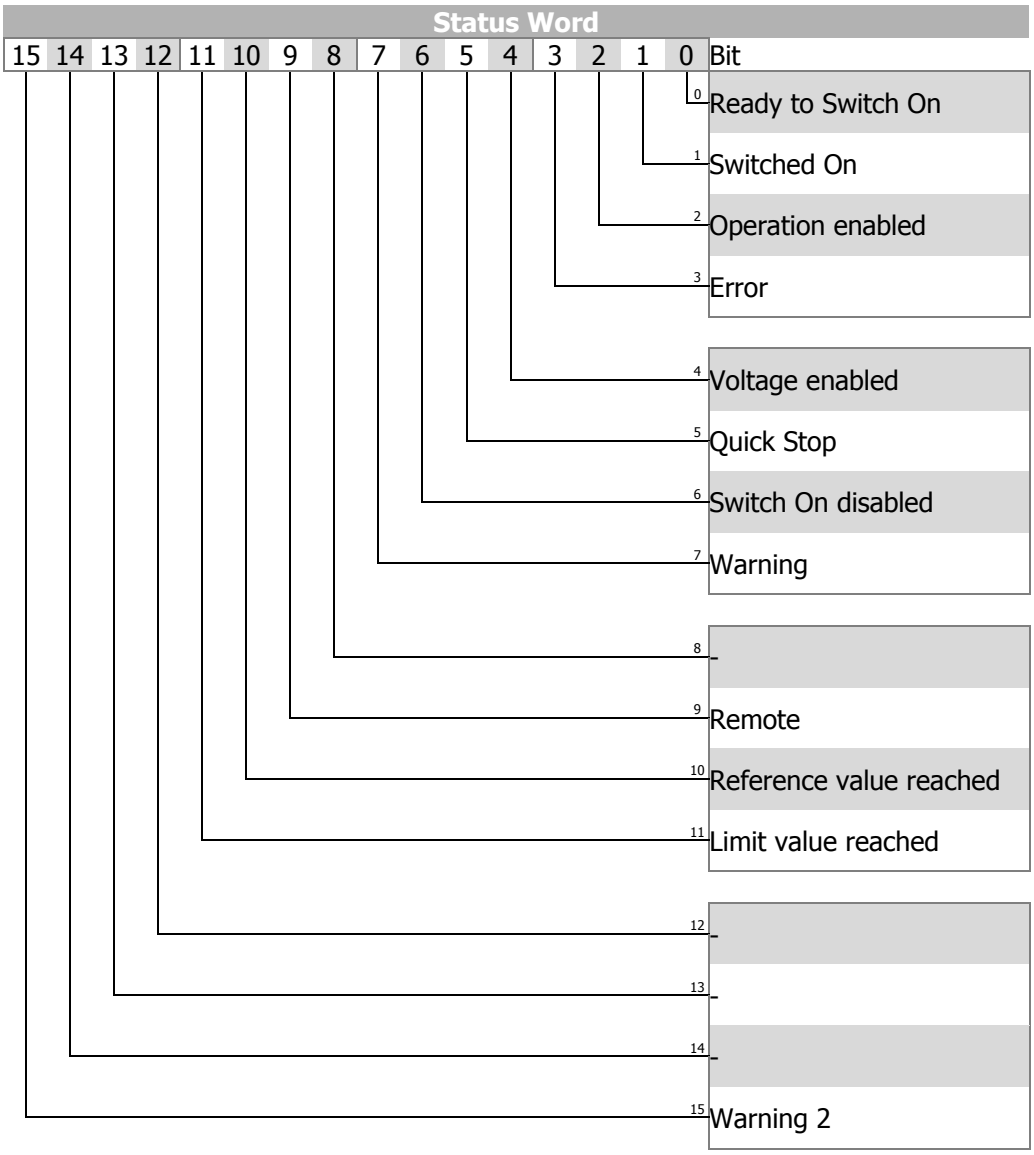
With the use of Remote Contacts the signal sources (digital inputs or multifunctional inputs set as digital inputs) are taken virtually from the *Control Word* **410**. Signals at the hardware terminals are not evaluated in the standard operation modes (e.g. 72 - IN2D).

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

Exceptions: The release must always be made via the Hardware-Inputs STOA (Terminal X11.3) and STOB (Terminal X13.3) and bit 0 "STOA+STOB" of the Control Word.

A Controller Release by software alone is not possible.

Parameter *Status Word* **411** has a length of 16 bits. The set bits have the following meaning:



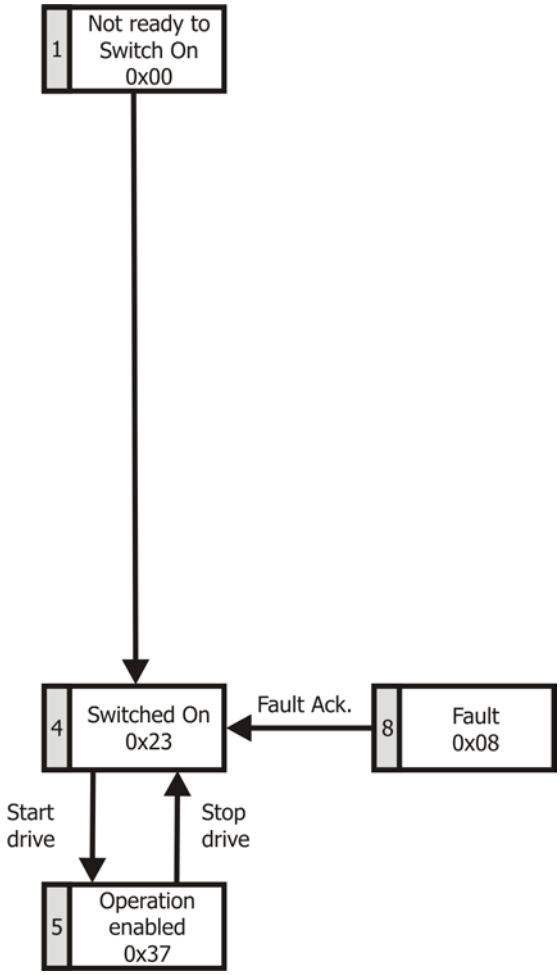
Note:
The frequency inverter supports an external 24 V voltage supply for the control electronics of the frequency inverter. Communication between the controlling device (PLC) and the frequency inverter is still possible even when the mains supply has been switched off.

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

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

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

10.1.1 Device 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
Error	x	1	x	x	x

"x" means any value.

If a fault has occurred, the cause of the fault can be read out via parameter *Current Error* **260**.

Status Word Bits 7 to 15:

Bit 7 **"Warning"** can signal an internal warning and results in the frequency inverter being switched off, depending on the cause. The evaluation of the warning is done by reading out the warning status via parameter *Warnings* **270**.

Bit 9, **"Remote"** is always set to 0 in the case of the control via contacts.

Bit 10 "**Reference value 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. For "Reference value reached" there is a hysteresis (tolerance range) which can be set via parameter *Reference Value Reached: Hysteresis* **549**.

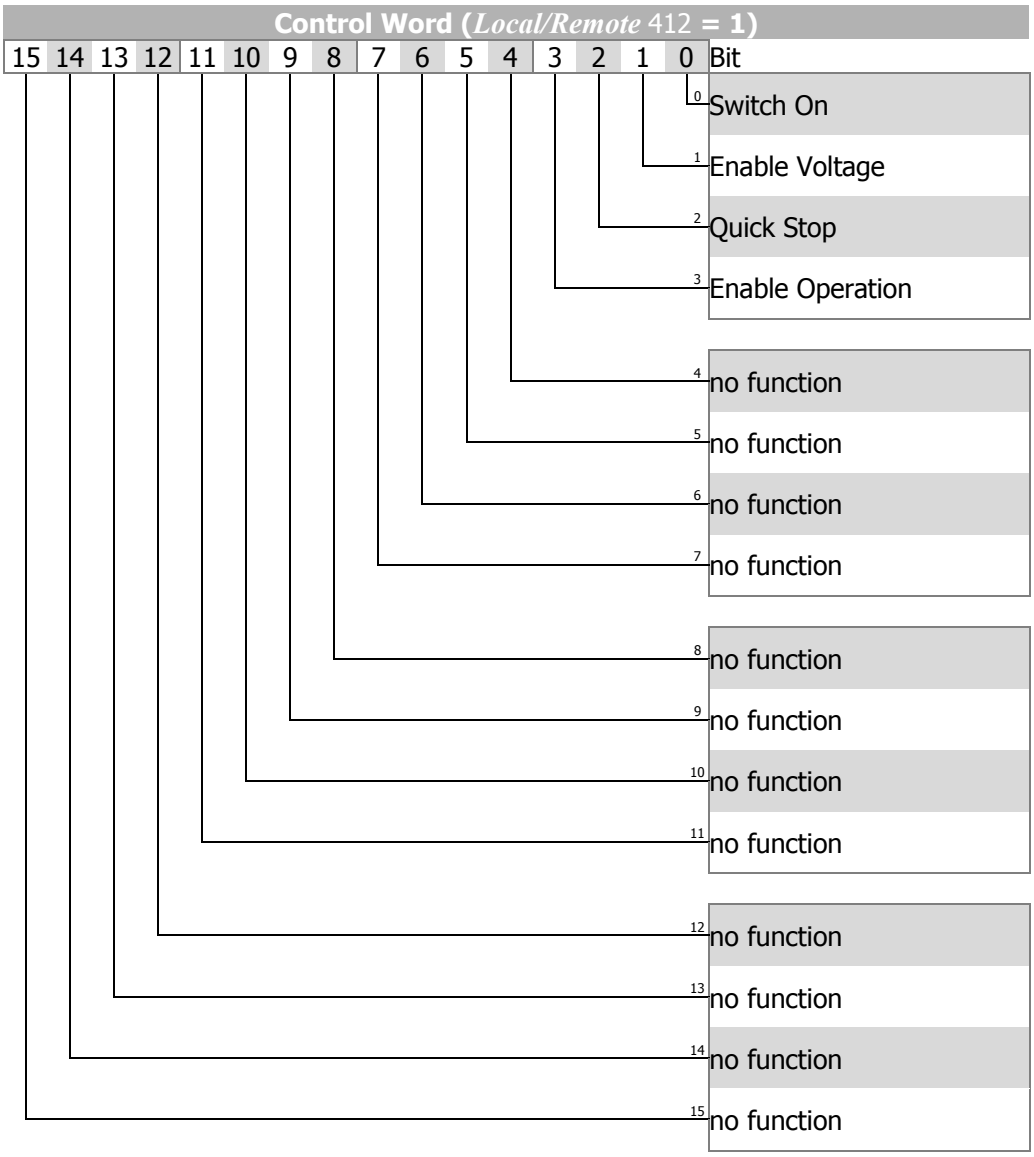
Bit 11 **"Limit value reached"** indicates that an internal limit is active. This may be the current limit, the torque limit or the overvoltage control. All functions result in the reference value being left or not reached.

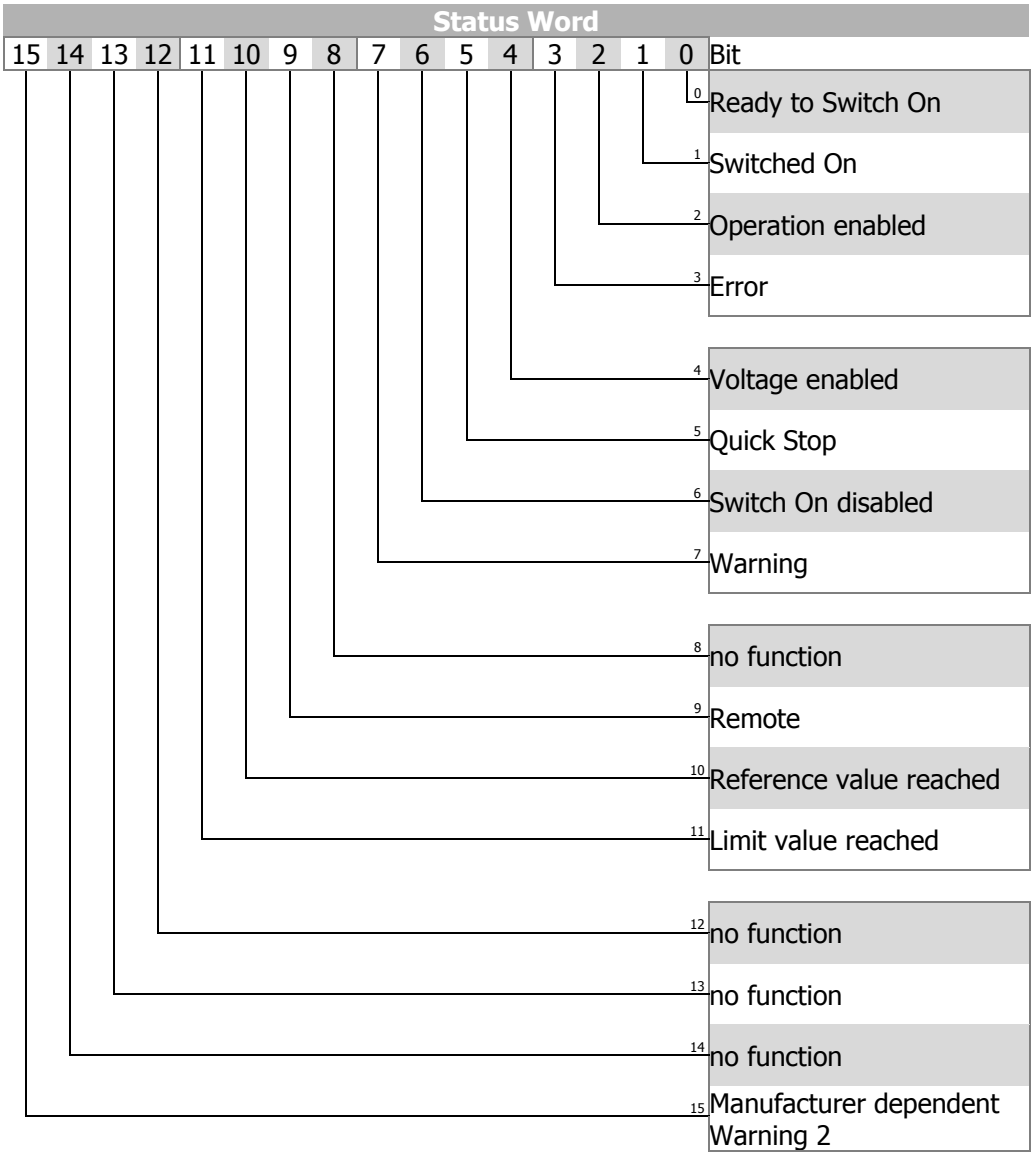
Bit 15 **"Warning 2"** signals a critical operating state which will result in a fault switch-off of the frequency inverter within a short time. This bit is set if there is a delayed warning relating to the motor temperature, heat sink/inside temperature, Ixt monitoring or mains phase failure.

10.2 Control via Statemachine

In the operation mode "Control via Statemachine" (*Local/Remote* **412** = 1) the frequency inverter is controlled via the Control Word of the Statemachine .

Transition 4 to state "Operation enabled" is only possible if the Controller Release via STOA and STOB and one of the digital inputs for Start Right or Start Left is set.





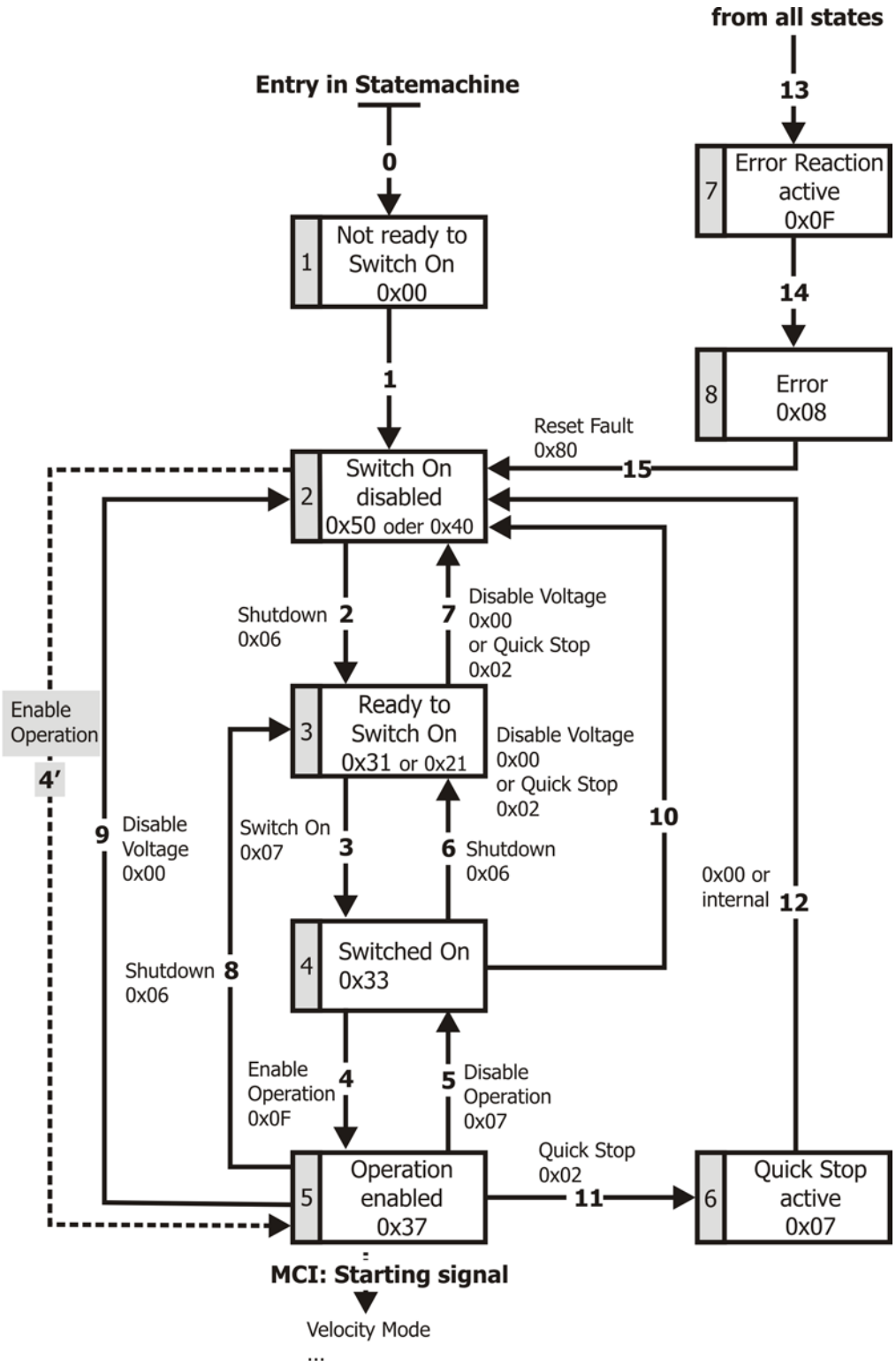
Note:
The frequency inverter supports an external 24 V voltage supply for the control electronics of the frequency inverter. Communication between the controlling device (PLC) and the frequency inverter is still possible even when the mains supply has been switched off.

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

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

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

10.2.1 Statemachine diagram



The device control commands are triggered by the following bit combinations in the Control Word:

Control Word						
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Command	Reset Fault	Enable Operation	Quick Stop	Enable Voltage	Switch On	Transitions
Shutdown	X	X	**1**	**1**	**0**	2, 6, 8
Switch On	X	**0**	**1**	**1**	**1**	3
Switch On	X	**1**	**1**	**1**	**1**	3
Disable Voltage	X	X	X	0	X	7, 9, 10, 12
Quick Stop	X	X	**0**	**1**	X	7, 10, 11
Disable Operation	X	**0**	**1**	**1**	**1**	5
Enable Operation	X	**1**	**1**	**1**	**1**	4
Reset Fault	**0 ⇨ 1**	x	x	x	x	15

"X" means any value.

Transition 3 (Command "Switch On") is only processed if Bit 4 "Voltage enabled" in the Status Word is set.

The Status Word reflects the operation state.

Status Word						
	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
State	Switch On disabled	Quick Stop	Error	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**
Error Reaction active	**0**	X	**1**	**1**	**1**	**1**
Error	**0**	X	**1**	**0**	**0**	**0**

"X" means any value.

Bit 7 "**Warning**" can be set at any time. It signals a device-internal warning. The active warning can be read out from the Warning Status with Parameter *Warnings* **270**.

Bit 9 "**Remote**" is set if the operation mode "Control via Statemachine" (*Local/Remote* **412** = 1) is set, and the Controller Release is switched on.

Logical combination of the digital control signals:
STO = (STOA and STOB) AND (Start Right OR Start Left).

The frequency inverter can only be controlled, if the logical combination is true. The logical inputs for Start Right and Start Left can be directly linked to "On" or "Off" (Parameter *Start Clockwise* **68** and *Start Anticlockwise* **69**).

Bit 10 "**Reference frequency 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 "Reference value reached" there is a hysteresis (tolerance range) which can be set via Parameter *Reference Value Reached: Hysterisis* **549** (see frequency inverter operating instructions).

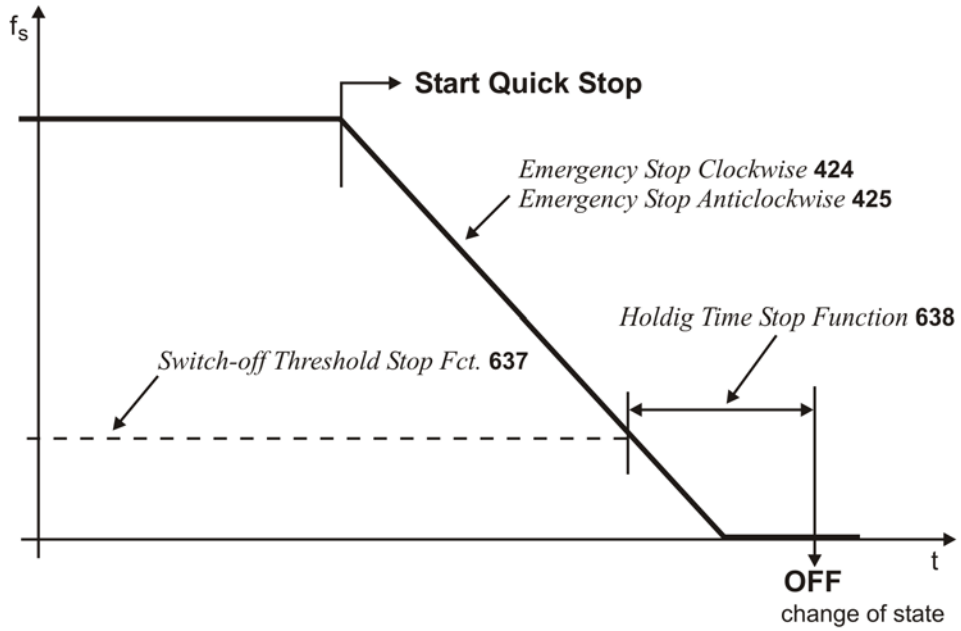
Bit 11 "**Limit value reached**" indicates that an internal limit is active. This may be the current limit, the torque limit or the overvoltage control. All functions result in the reference value being left or not reached.

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.

10.3 Behavior in Quick Stop

In this case, the parameters *Switch-Off Threshold Stop Function* **637** (percentage of parameter *Maximum Frequency* **419**) and *Holding Time Stop Function* **638** (holding time after the value drops below the switch-off limit) are relevant.

In a quick stop, the drive is brought to a standstill via the emergency stop ramps (*Emergency Stop Clockwise* **424** or *Emergency Stop Anticlockwise* **425**).



If the 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.

10.4 Behavior in State-Transition 5

- **392 state-transition 5**

The behavior in transition 5 (from "Operation enabled" to "Switched On") can be set via Parameter *state-transition 5* **392**.

Transition 5 392	Function
0 - Coast to Stop	Immediate transition from "Operation released" 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 at normal ramp, when the drive has come to a standstill, there is the change from "Operation enabled" to "Switched On".

Setting 1 "DC-Brake" is only possible with applications with sensor-less 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 DC-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 Operator Panel or VPlus PC-Software.

The default value for *state-transition 5* **392** is 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 value 1 "Direct current brake", a new Control Word will only be accepted after the transition process is complete. The change of state from "Operation released" to "Switched On" is carried out 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 0x0F 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 case, the parameters *Switch-Off Threshold Stop Function* **637** (percentage of parameter *Maximum Frequency* **419**) and *Holding Time Stop Function* **638** (holding time after the value drops below the switch-off limit) are relevant.

11 Actual Values

Actual Values		
No.	**Description**	**Function**
11	VABus SST-Error-Register	VABus Error Register. See Chapter 6 "VABus" und 7.3 "Telegram Check / Error Acknowledgement".
282	Reference Bus Frequency	Reference value from the serial interface.
283	Reference Ramp Frequency	Reference value from the Reference Frequency Channel.
411	Status Word	Modbus or VABus Status Word. See Chapter 10 "Control / Reference Value".

12 Parameter List

The parameter is available in the four data sets.

12.1 Actual Values ("Actual" Menu)

Actual Value Parameters				
No.	**Description**	**Units**	**Value Range**	**Chapter**
RS485/RS232				
11	VABus SST-Error-Register	-	0... 15	7.3
Actual Frequency Inverter Values				
249	Active Data Set	-	0 ... 4	11
260	Actual Error	-	0 ... 0xFFFF	13.3
270	Warnings	-	0 ... 0xFFFF	13.1
274	Application Warnings	-	0 ... 0xFFFF	13.2
282	Reference Bus Frequency	Hz	-999,99 ... 999,99	11
283	Reference Ramp Frequency	Hz	-999,99 ... 999,99	11
Bus Control				
411	Status Word	-	0 ... 0xFFFF	10

12.2 Parameters ("Para" Menu)

Parameter				
No.	**Description**	**Units**	**Value Range**	**Chapter**
RS485/RS232				
10	VABus-CM Baud rate	-	Selection	6.2
Bus Control				
392	state-transition 5	-	Selection	10.4
RS485/RS232				
394	CM: VABus NodeID	-	1 ... 30	6.2
395	Protocol (CM / X21)	-	Selection	5.4
Bus Control				
410	Control Word	-	0 ... 0xFFFF	10
412	Local/Remote	-	Selection	10
414	Data Set Selection	-	0 ... 4	11
RS485/RS232				
413	CM: VABus Watchdog Timer	s	0 ... 1000	6.2, 7.4
Fixed Frequency Values				
484	Reference Frequency RAM	Hz	-999,99 ... 999,99	10
Fixed Percentage Values				
524	Reference Percentage RAM	%	-300,00 ... 300,00	10
VABus (X21-Connection)				
1500	X21: VABus Baud rate	-	Selection	6.1
1501	X21: VABus Node-ID	-	1 ... 30	6.1
1502	X21: VABus Watchdog Timer	s	0 ... 1000	6.1

13 Annex

13.1 Warning Messages

The warning messages are given via parameter *Warnings* **270**, bit-coded according to the following scheme.
Parameter *Warnings* **269** shows the warnings in clear text on the operator panel and the PC software tool VPlus.
Use Parameter *Warnings* **270** to access the warning codes via VABus.

Warning Messages			
Bit-No.	**Warning Code**	**Description**	
0	0x0001	Warning Ixt	1) 2)
1	0x0002	Warning Short Time Ixt	1)
2	0x0004	Warning Long Time Ixt	2)
3	0x0008	Warning Heat Sink Temperature Tk	
4	0x0010	Warning Inside Temperature Ti	
5	0x0020	Warning I-Limit	
6	0x0040	Warning Init	
7	0x0080	Warning Motor Temperature	
8	0x0100	Warning Mains Phase Failure	
9	0x0200	Warning Motor Protective Switch	
10	0x0400	Warning Fmax	
11	0x0800	Warning Analog Input MFI1A	
12	0x1000	Warning Analog Input MFI2A	
13	0x2000	Warning Systembus Slave in Fault	
14	0x4000	Warning Udc	
15	0x8000	Warning V-Belt	

1) 2): Bit 0 "Warning Ixt" is set,

- if Bit 1 "Warning Short Term Ixt" or
- if Bit 2 "Warning Long Term Ixt" is set.

In Parameter *Warnings* **270** several warnings can be set at the same time.

Example:

Message	Warning Code	Comment
Warning Ixt	0x0001	Set on Short Term or Long Term Ixt.
Short Term Ixt	0x0002	
Warning Limit Heat Sink Temperature	0x0008	
Warning Limit Motor Temperature	0x0080	
Sum	**0x008B**	

13.2 Warning Messages Application

When the highest bit in the Warning messages is set, a "Warning Message Application" is present. The Application warning messages are given via parameter *Application Warnings* **274**, bit-coded according to the following scheme.
Parameter *Application Warnings* **273** shows the warnings in clear text on the operator panel and the PC software tool VPlus.
Use Parameter *Application Warnings* **274** to access the Application warning codes via Profibus.

Warning Messages		
Bit-No.	**Warning Code**	**Description**
0	0x0001	BELT - Keilriemen
1	0x0002	(reserviert)
2	0x0004	(reserviert)
3	0x0008	(reserviert)
4	0x0010	(reserviert)
5	0x0020	(reserviert)
6	0x0040	SERVICE
7	0x0080	User 1
8	0x0100	User 2
9	0x0200	(reserviert)
10	0x0400	(reserviert)
11	0x0800	(reserviert)
12	0x1000	(reserviert)
13	0x2000	(reserviert)
14	0x4000	(reserviert)
15	0x8000	(reserviert)

Note: The meaning of the individual warnings are described in detail in the operating instructions.

13.3 Error Messages

VABus		
F20	10	Watchdog for X21-Connection. Communication error according to Parameter *X21: VA-Bus Watchdog Timer* **1502**.
	11	Watchdog for Communication Module. Communication error according to Parameter *CM: VABus Watchdog Timer* **413**.

The Actual error message can also be read out by parameter access via parameter *Actual Fault* **260**.
Parameter *Actual Error* **259** shows the actual error in clear text on the operator panel and the PC software tool VPlus.

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