Bonfiglioli
Vectron

Agile

Systembus 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 Systembus protocol. The modular hardware and software structure allows the 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 software configuration.

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.

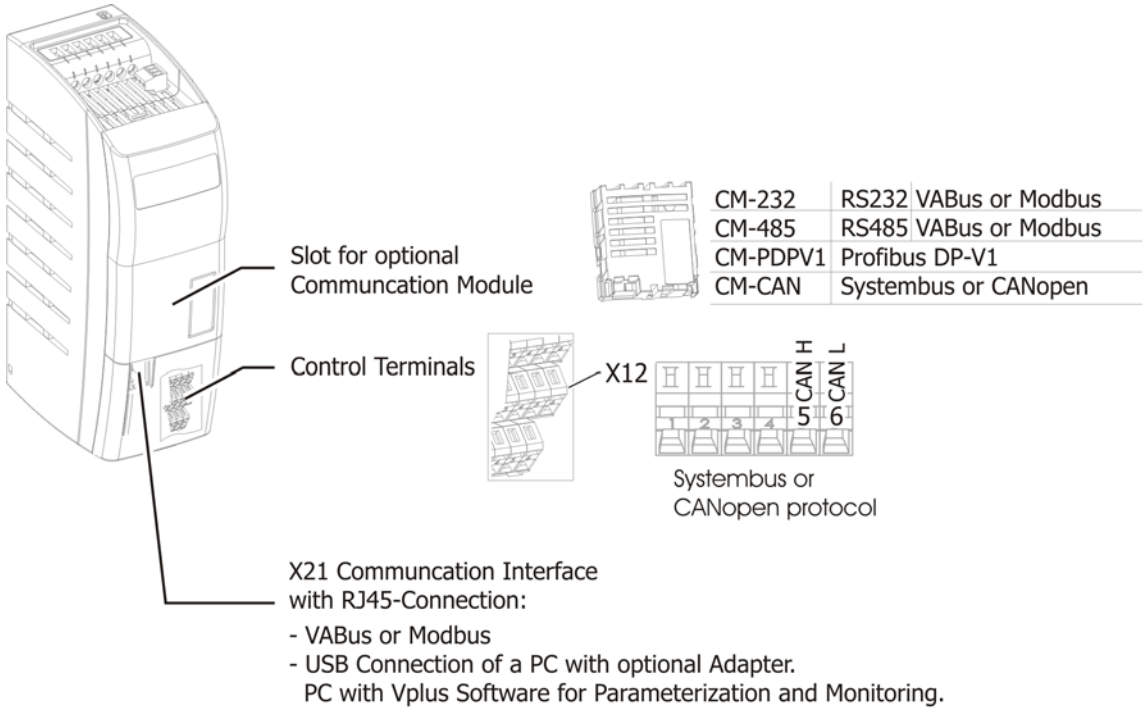
Check protective equipment regularly.

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
Control terminals for CAN-Connection	Instructions for or CANopen®[1]
CM-CAN	
X21 Communication Interface (Install an Interface Adapter in order to connect a PC. This enables parameterization and monitoring with the VPlus PC-Software).	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.

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

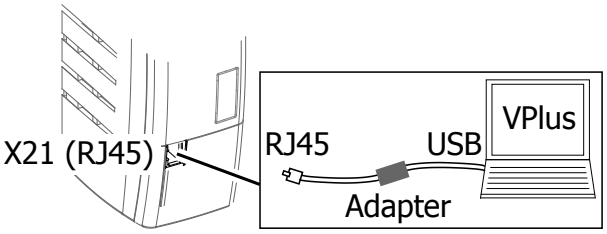
Optional Communication Module (CM)		Frequency Inverter Terminals X12.5 and X12.6
CANopen®[1]	as well as	Systembus
Systembus	as well as	CANopen®[1]

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

3.1 VPlus PC-Software

In some chapters the settings and display possibilities are described with the help of the VPlus PC-Software.

The USB-Interface of a PC can be connected to the X21 Communication Interface via an optional USB adapter. This enables parameterization and monitoring with the help of the VPlus PC-Software.



4 Installation of an optional Communication Module

4.1 Assembly

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

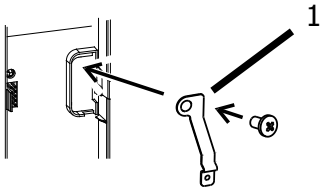
Caution!

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

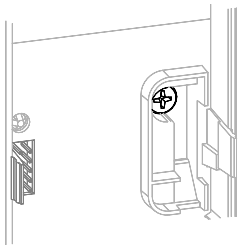
Installation under voltage is not permitted and will destroy the frequency inverter and/or the communication module.

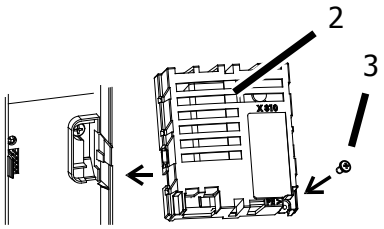
Do not touch the PCB visible on the back of the module, otherwise components may be damaged.

- Remove the cover of the module slot.



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

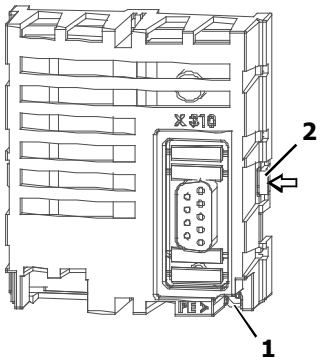




- Insert the communication module (2).
- Screw the communication module (2) onto the frequency inverter with the screw provided (3).
- Break off the pre-punched cut-out from the cover.
- Replace the cover.

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 Connection

The CAN-Connection of the Systembus is physically laid out according to ISO-DIS 11898 (CAN High Speed).

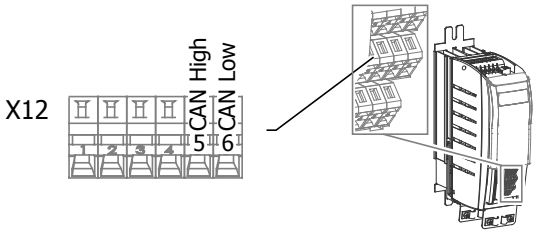
Caution!

The frequency inverter must be disconnected from the power supply before installation and connection work. Make sure that the frequency inverter is de-energized.

Installation under voltage is not permitted and can lead to the destruction of the frequency inverter and/or the communication module.

5.1 Connection to the Terminals

Connect the bus to the X12.5 and X12.6 terminals of the frequency inverter.

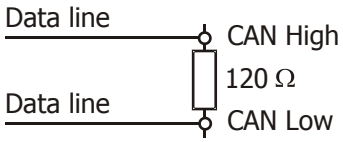


Cable

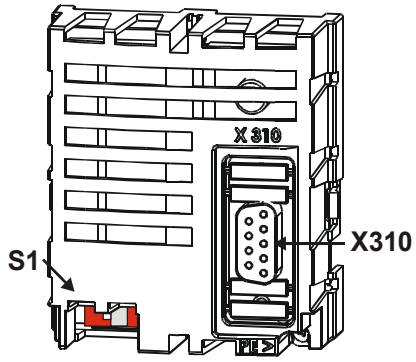
- For the bus line use a twisted and shielded cable.
- Implement the shield as a braided shield (not a foil shield).
- Connect the cable shield surfaces to PE at both ends.

Bus Termination

Connect the bus termination, necessary on one cable, at the first and last physical participant.



5.2 Module Connection

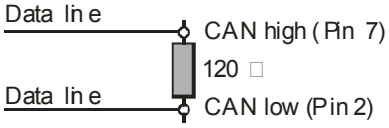


The **X310** (9-pin D-Sub) bus plug has been designed according to DS102 Version 2.0 (Bus node, option A).
Details can be seen from the following table on the occupancy of the bus plug.

The bus termination necessary on a phase in the physically first and last subscriber can be activated via **DIP switch S1** on the communication module.

The factory setting for the bus termination is OFF.

As an alternative, this is also possible via corresponding circuits in the bus connection plugs.



Attention!
Make absolutely sure that only one of the two possibilities for the bus termination is used and the bus termination is only switched on with the first and last subscriber. Otherwise, operation of the CANopen® communication is not possible.

Bus Connector X310		
Pin	**Name**	**Function**
Housing	Shield	connected with PE.
1	CAN_L	CAN-Low Bus-Interface short-circuit resistant and function-insulated, max. current 60 mA
2	CAN_L	CAN-Low Bus-Interface short-circuit resistant and function-insulated, max. current 60 mA
3	CAN_GND	Earth/GND
4	n.c.	not used.
5	n.c.	not used.
6	CAN_GND	Earth/GND
7	CAN_H	CAN-High Bus-Interface short-circuit resistant and function-insulated, max. current 60 mA
8	CAN_H	CAN-High Bus-Interface short-circuit resistant and function-insulated, max. current 60 mA
9	-	do NOT connect.

For the bus line, use twisted cable with harness shield (**no foil shield**).

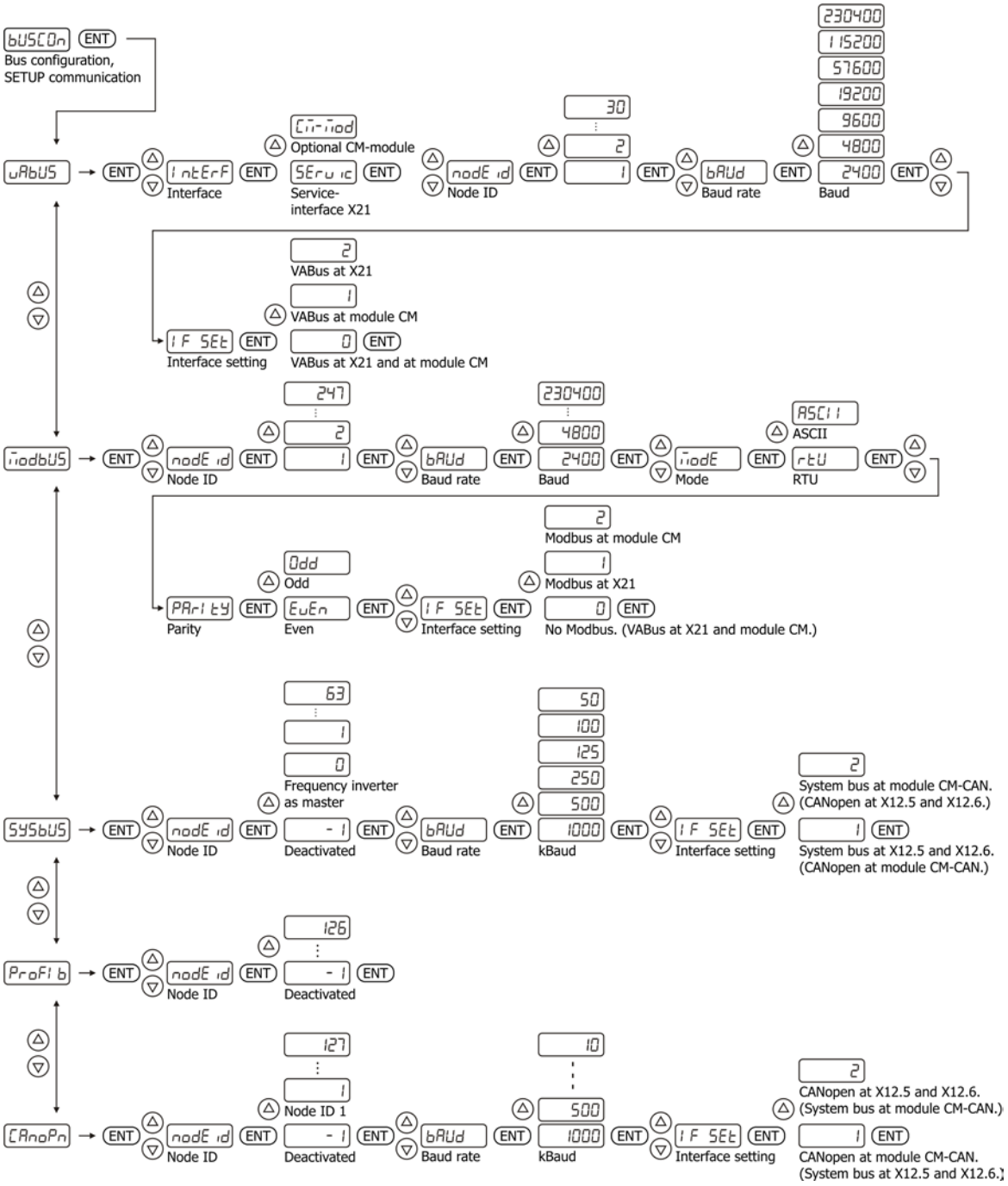
Attention!
The harness screen of the data lines is to be connected to ground (PE) on both sides on a large area.

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.



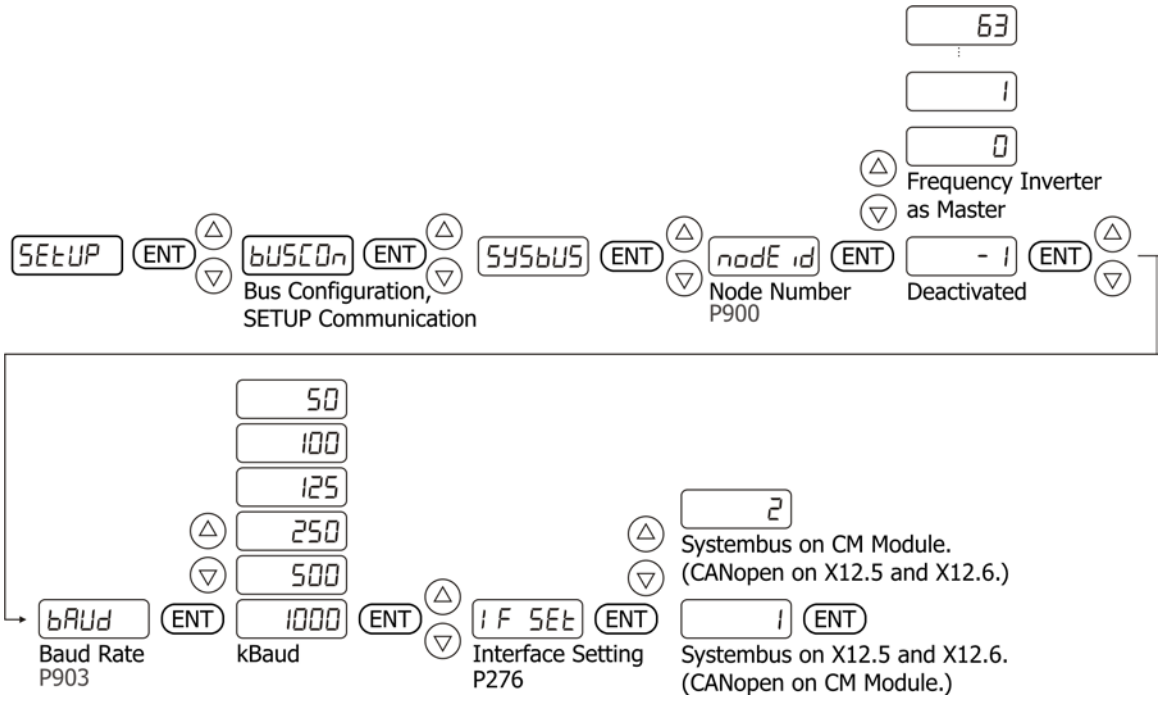
5.3.2 Select the Protocol

- Select Systembus.

	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 (the selection is only possible if an optional CM-PDPV1 Communication Module is installed)	Pr-OFI b
Systembus	SYSbUS
Modbus	⁻odbUS
VABus	uAbUS
	(ENT)

5.3.3 Set the Communication Parameters

Parameter		Display
900	Node Number	nodE id
903	Baud Rate	bAUd
276	CAN Interface (CM-CAN/X12). Interface setting. – Set the X12.5 and X12.6 Terminals to Systembus. Or: – Set an optional Communication Module CM-CAN to Systembus.	I F SEt 1 2



5.4 Set the Protocol for the Terminals and Communication Module

- **276 CAN Interface (CM-CAN/X12)**

With Parameter *CAN Interface (CM-CAN/X12)* **276** the terminals of the frequency inverter and an optional Communication Module (CM) can be set to a communication protocol. In the factory setting (1 - CANopen/CAN-Systembus) the terminals of the frequency inverter are set to CAN-Systembus.

CM-CAN/CAN-Terminals	Function	
1 - CANopen/CAN-Systembus	Optional Communication Module: Frequency Inverter Terminals X12.5 and X12.6:	CANopen® Systembus
2 - CAN-Systembus/CANopen	Optional Communication Module: Frequency Inverter Terminals X12.5 und X12.6:	Systembus CANopen®

CM-CAN: Optional Communication Module
CAN-Terminals: Terminals X12.5 and X12.6 of the frequency inverter.

Simultaneous CANopen®-Communication via the terminals of the frequency inverter and via a Communication Module is not possible.

Simultaneous Systembus-Communication via the terminals of the frequency inverter and via a Communication Module is not possible.

6 Systembus

6.1 Bus Control

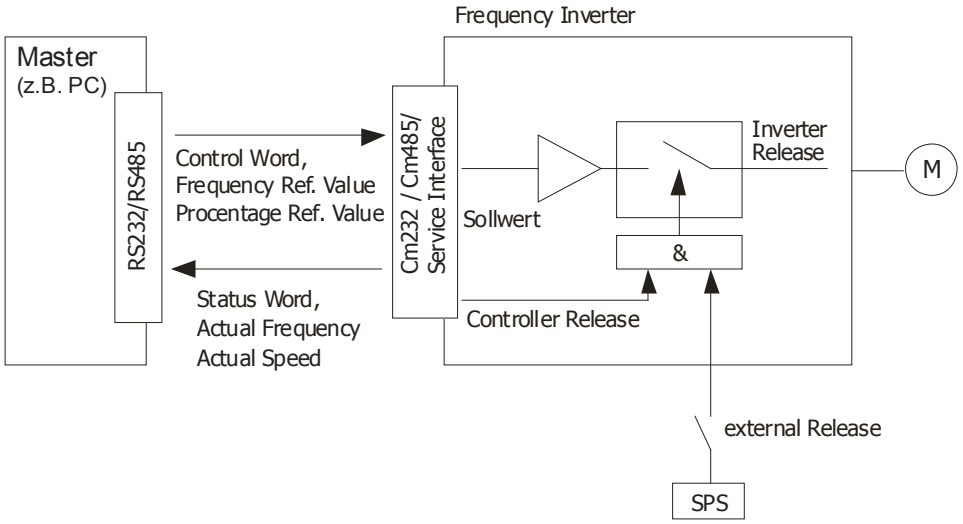
The frequency inverters can be expanded for data communication via various options and can therefore be integrated into automation and control systems. The parameterization and commissioning can be carried out via the operator panel or via an optional communication module.

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

The frequency inverter can be controlled completely via the Systembus. 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**

Parameter *Local/Remote* **412** determines how the commands for Start, Stop and direction of rotation are given. The parameter allows the selection between control via contacts, operator panel or communication interface.

Local/Remote **412**	Function
0 - Control via Contacts	The Start and Stop commands as well as the direction of rotation (Parameter *Start-right* **68**, *Start-left* **69**) are set via digital signals.
1 - Control via Statemachine	The Start and Stop commands as well as the direction of rotation are set via the remote Statemachine of the communication interface.
2 - Control via Remote Contacts	The Start and Stop commands as well as the direction of rotation are set via logical signals from the communication interface.
3 - Control via Operator Panel	The Start and Stop commands as well as the direction of rotation are set via the operator panel.
4 - Control via Operator Panel or Contacts	The Start and Stop commands as well as the direction of rotation are set via the operator panel or via digital signals. Factory setting.
5 - 3-Wire Control	Control of the direction of rotation (Parameter *Start-right* **68**, *Start-left* **69**) and of the signal *Start 3-Wire Ctrl* **87** via digital inputs.

Note:
If the operation mode is changed while the drive is running, then the drive will not stop unless the stop command is set in the newly selected operation mode.

The control of the drive requires the release of the power element via the setting of digital inputs STOA and STOB.

- **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**.

6.2 Baud Rate Setting / Line Lengths

- **903 Baud-Rate**

The setting of the baud rate must be identical in all nodes on the Systembus. The maximum possible baud rate is based on the necessary overall line length of the Systembus. The baud rate is set via the parameter *Baud-Rate* **903** and thus defines the possible line length.

Baud-Rate **903**	Function	max. line length
3 - 50 kBaud	Transmission rate 50 kBaud	1000 Meter
4 - 100 kBaud	Transmission rate 100 kBaud	800 Meter
5 - 125 kBaud	Transmission rate 125 kBaud	500 Meter
6 - 250 kBaud	Transmission rate 250 kBaud	250 Meter
7 - 500 kBaud	Transmission rate 500 kBaud	100 Meter
8 - 1000 kBaud	Transmission rate 1000 kBaud	25 Meter

A baud rate under 50 kBaud, as is defined according to CANopen®, is not sensible for the Systembus as the data throughput is too low.

The maximum line lengths stated are guidelines. If they are made complete use of, a calculation of the admissible length is to be done on the basis of the line parameters and the bus driver (PCA82C250T).

6.3 Node Address Setting

- **900 Node-ID**

A maximum of 63 slaves or frequency inverters with Systembus can be operated on the Systembus. Each frequency inverter is given a node ID, which may only exist once in the system, for its unambiguous identification. The setting of the Systembus node ID is carried out via parameter *Node-ID* **900**.

Parameter		Setting		
No.	**Description**	**min.**	**max.**	**Factory setting**
900	Node-ID	-1	63	-1

The Systembus possesses a maximum number of 63 nodes (Network nodes), plus one frequency inverter as a master.

Note:
With the factory setting of parameter *Node-ID* **900** = -1, the Systembus is deactivated for this frequency inverter.

If the *Node-ID* **900** = 0 is set, the frequency inverter is defined as a master. Only one frequency inverter on the Systembus may be defined as a master.

7 Protocol

7.1 Functional Overview

To start with, the Systembus produces the physical connection between the frequency inverters. Logical communication channels are produced via this physical medium. These channels are defined via the identifiers. As CAN does not possess a node-oriented, but a message-oriented addressing via the identifiers, the logical channels can be displayed via it.

In the factory setting the identifiers are set according to the Predefined Connection Set of CANopen®. These settings are aimed at one master serving all the channels. In order to be able to build up process data movement via the PDO channels between individual or a number of inverters (transverse movement), the setting of the identifiers in the nodes has to be adapted.

Note:
The data exchange is performed message-oriented. A frequency inverter can transmit and receive a number of messages, identified by various identifiers.

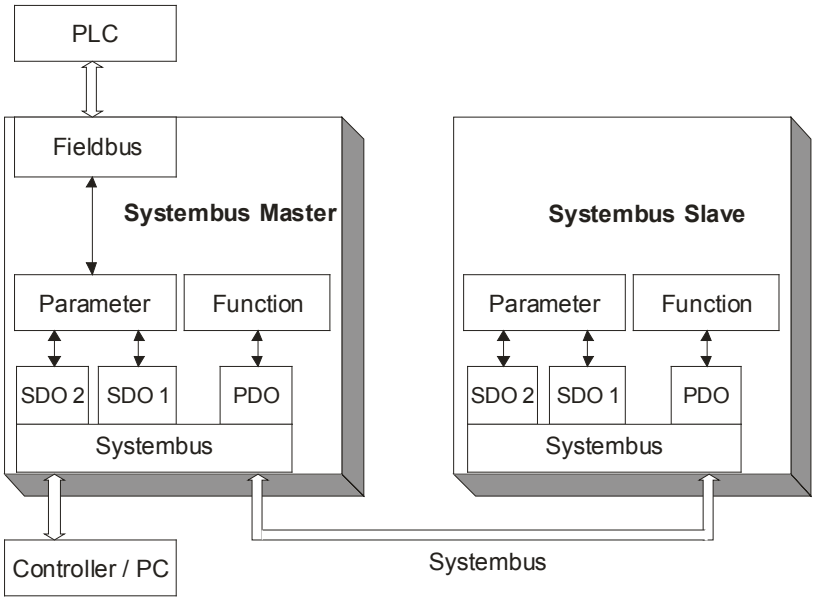
As a special feature, the properties of the CAN bus mean that the messages transmitted by one node can be received by a number of nodes simultaneously. The error monitoring methods of the CAN bus result in the message being rejected by all recipients and automatically transmitted again if there is a faulty reception in one receiver.

7.2 Network Management

The network management controls the start of all the nodes on the Systembus. Nodes can be started or stopped individually or together. For node recognition in a CAL or CANopen®-System, the slaves on the Systembus generate a starting telegram (boot-up message).

If a fault occurs, the slaves automatically transmit a fault telegram (Emergency-Message).

For the functions of the network management, the methods and NMT telegrams (network management telegrams) defined according to CANopen (CiA DS 301) are used.



7.2.1 SDO-Channels (Parameter Data)

Each frequency inverter possesses two SDO channels for the exchange of parameter data. In a slave device, these are two server SDOs, in a device defined as a master a client SDO and a server SDO. Attention must be paid to the fact that only one master for each SDO channel may exist in a system.

Note:
Only one master can initiate by the Systembus an exchange of data via its client SDO.

The identifier assignment for the SDO channels (Rx/Tx) is done according to the Predefined Connection Set.

This assignment can be amended by parameterization, in order to solve identifier conflicts in a larger system in which further devices are on the CAN bus alongside the frequency inverters.

Attention!
In a system in which a frequency inverter works as a master, the identifier allocations for the SDO channel may not be altered.

In this way, an addressing of individual nodes via the field bus/Systembus path of the master frequency inverter is possible.

Parameters are read/written via the SDO channels. With the limitation to the SDO Segment Protocol Expedited, which minimizes the handling needed for the parameter exchange, the transmittable data are limited to the uint / int / long types. This permits complete parameterization of the frequency inverters via the Systembus, as all the settings and practically all the actual values are displayed via these data types.

7.2.2 PDO-Channels (Process Data)

- **930 TxPDO1 Function**
- **932 TxPDO2 Function**
- **934 TxPDO3 Function**
- **936 RxPDO1 Function**
- **937 RxPDO2 Function**
- **938 RxPDO3 Function**

Each frequency inverter possesses three PDO channels (Rx/Tx) for the exchange of process data.

The identifier assignment for the PDO channel (Rx/Tx) is done by default according to the Predefined Connection Set. This assignment corresponds to an alignment to a central master control.

In order to produce the logical channels between the devices (transverse movement) on the Systembus, the amendment of the PDO identifiers for Rx/Tx is necessary.

Each PDO channel can be operated with time or SYNC control. In this way, the operation behavior can be set for each PDO channel.

The setting of the operation mode is done via the following parameters:

TxPDO1 Function **930**, *TxPDO2 Function* **932** and *TxPDO3 Function* **934**

RxPDO1 Function **936**, *RxPDO2 Function* **937** and *RxPDO3 Function* **938**

Operation mode	TxPDO Function
0 - deactivated	No data exchange via the PDO-Channel.
1 - time controlled	Tx-PDOs cyclically transmit according to the time specification.
2 - SYNC controlled	Tx-PDOs transmit the data from the application that are then current after the arrival of the SYNC telegram.

Operation mode	RxPDO Function
1 - time controlled	Rx-PDOs are read in with Ta = 1 ms and forward the data received to the application.
2 - SYNC controlled	Rx-PDOs forward the last data received to the application after the arrival of the SYNC telegram.

For synchronous PDOs, the master (PC, PLC or frequency inverter) generates the SYNC telegram. The identifier assignment for the SYNC telegram is done by default according to the Predefined Connection Set. This assignment can be altered by parameterization.

7.3 Master Functionality

An external control or a frequency inverter defined as a master (node ID = 0) can be used as a master. The fundamental tasks of the master are controlling the start of the network (boot-up sequence), generating the SYNC telegram and evaluating the emergency messages of the slaves.

Furthermore, there can be access to the parameterization of all the frequency inverters on the Systembus by means of a field bus connection via the client SDO of the master frequency inverter.

7.3.1 Control Boot-Up-Sequence, Network Management

The Minimum Capability Boot-Up method defined according to CANopen® is used for state control of the nodes.

This method knows the pre-operational, operational and stopped states.

After the initialization phase, all the nodes are in the pre-operational state. The Systembus master transmits the NMT command **Start-Remote-Node**. With this command, individual nodes or all the nodes can be started together. The frequency inverter defined as a master starts **all** the nodes with **one** command. After receipt of the Start Remote Node command, the nodes change into the Operational state. From this time on, process data exchange via the PDO channels is activated.

A master in the form of a PLC/PC can start the nodes on the Systembus individually and also stop them again.

- **904 Boot-Up Delay**

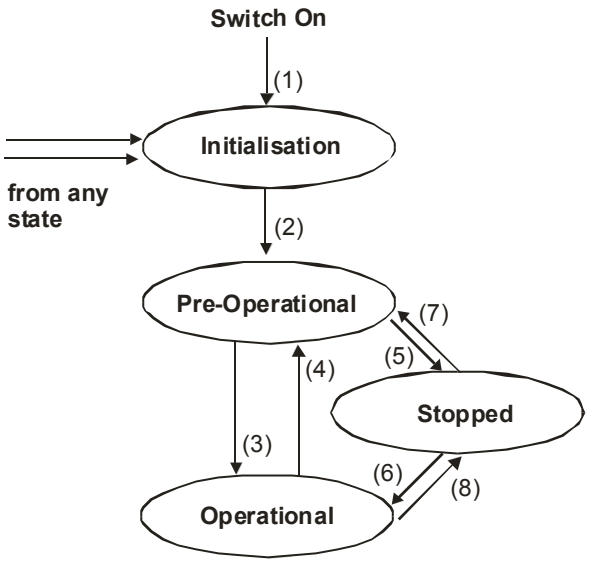
A master in the form of a PLC/PC can start the nodes on the Systembus individually and also stop them again. The setting is done in a frequency inverter defined as a Systembus master via *Boot-Up Delay* **904**.

Parameter		Setting		
Nr.	**Description**	**Min.**	**Max.**	**Factory setting**
904	Boot-Up Delay	3500 ms	50000 ms	3500 ms

Properties of the States:

State	Properties
Pre-Operational	Parameterization via SDO channel possible, Exchange of process data via PDO channel not possible
Operational	Parameterization via SDO channel possible, Exchange of process data via PDO channel possible
Stopped	Parameterization via SDO channel not possible, Exchange of process data via PDO channel not possible

Note:
Start-Remote-Node is cyclically transmitted with the set delay time by a frequency inverter defined as a Systembus master, in order to put slaves added with a delay or temporarily separated from the network back into the Operational state.



After Power On and the initialization, the slaves are in the Pre-Operational state.

Transition (2) is automatic. The Systembus master (frequency inverter or PLC/PC) triggers transition (3) to the Operational state.

The transitions are controlled via NMT telegrams.

The identifier used for the NMT telegrams is "0" and may only be used by the Systembus master for NMT telegrams. The telegram contains two data bytes.

Byte 0	Byte 1
CS (Command Specifier)	Node-ID

Identifier = 0

With the specification of the Node-ID ≠ 0, the NMT command acts on the node selected via the Node-ID. If Node-ID = 0, all nodes are addressed.

Transition	Command	Command Specifier
(3) , (6)	Start Remote Node	1
(4) , (7)	Enter Pre-Operational	128
(5) , (8)	Stop Remote Node	2
-	Reset Node	129
-	Reset Communication	130

Note:
A frequency inverter defined as a Systembus master only transmits the command "Start Remote Node" with node ID = 0 (for all nodes). Transmission of the command is done after completion of the initialization phase and the time delay *Boot-Up Delay* **904** following it.

7.3.2 SYNC-Telegram Generation

- **918 SYNC-Identifier**

If synchronous PDOs have been created on the Systembus, the master must send the SYNC telegram cyclically. If a frequency inverter has been defined as a Systembus master, the latter must generate the SYNC telegram. The interval for the SYNC telegram of a frequency inverter defined as the Systembus master is adjustable. The SYNC telegram is a telegram without data.

According to the Predefined Connection Set, the default identifier = 128.

If a PC or PLC is used as a master, the identifier of the SYNC telegrams can be adapted by parameterization on the frequency inverter.

The identifier of the SYNC telegram must be set identically in all nodes on the Systembus.

The setting of the identifier of the SYNC telegram is done via the parameter *SYNC-Identifier* **918**.

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
918	SYNC-Identifier	0	2047	0

The setting "0" results in identifier assignment according to the Predefined Connection Set.

Attention!
The identifier range 129...191 may not be used as the emergency telegrams can be found there.

- **919 SYNC-Time**

The temporal cycle for the SYNC is set on a frequency inverter defined as a Systembus master via the parameter *SYNC-Time* **919**.

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
919	SYNC-Time	0 ms	50000 ms	0 ms

Note:
A setting of 0 ms for the parameter *SYNC-Time* **919** means "no SYNC telegram".

7.3.3 Emergency-Message, Reaction

If a slave on the Systembus suffers a fault, it transmits the emergency message. The emergency message marks the node ID for the identification of the failed node via its identifier and the existing fault message via its data contents (8 bytes).

After a fault has been acknowledged on the slave, the latter again transmits an emergency message with the data content zero.

The emergency message has the identifier 128 + Node-ID (= 129 ... 191)

- **989 Emergency Reaction**

The Systembus master evaluates the emergency messages of the slaves. Its reaction to an emergency message can be set with Parameter *Emergency Reaction* **989**.

Emergency Reaction 989	Function
0 - Error	The Emergency Message leads to a fault on the Systembus master.
1 - No Error	The Emergency Message is displayed as a warning.
2 - Ignore	The Emergency Message is ignored. No reaction.

Operation Mode Parameter 989 = 0 – Error

Systembus behavior in *Emergency Reaction* **989**= 0 - Error:

As soon as the Systembus master receives an emergency message, it also breaks down and reports the failed node on the basis of its ID via the kind of error. Only the node is reported, not the cause of the error.

The fault message on the Systembus master via *Current error* **260** is **21nn** with **nn = Node-ID** (hexadecimal) of the slave in which a fault switch-off exists.

In addition, the Systembus master reports the warning Sysbus (0x2000) via the parameter *Warnings* **270** Bit 13.

If a fault switch-off occurs on a number of slaves, the first slave to transmit its emergency message is displayed on the Systembus master.

Operation Mode Parameter 989 = 1 – No Error

Systembus behavior in *Emergency Reaction* **989**= 1 - No Error:

As soon as the Systembus master receives an emergency message, it reports the warning Sysbus (0x2000) via the parameter *Warnings* **270** Bit 13.

In both cases, the Boolean variable SysbusEmergency with source number 730 is set to TRUE in the Systembus master. It can be used in the Systembus master and (in transmission via a TxPDO) in the slaves for a defined shutdown.

SysbusEmergency is also set if the Systembus master breaks down.

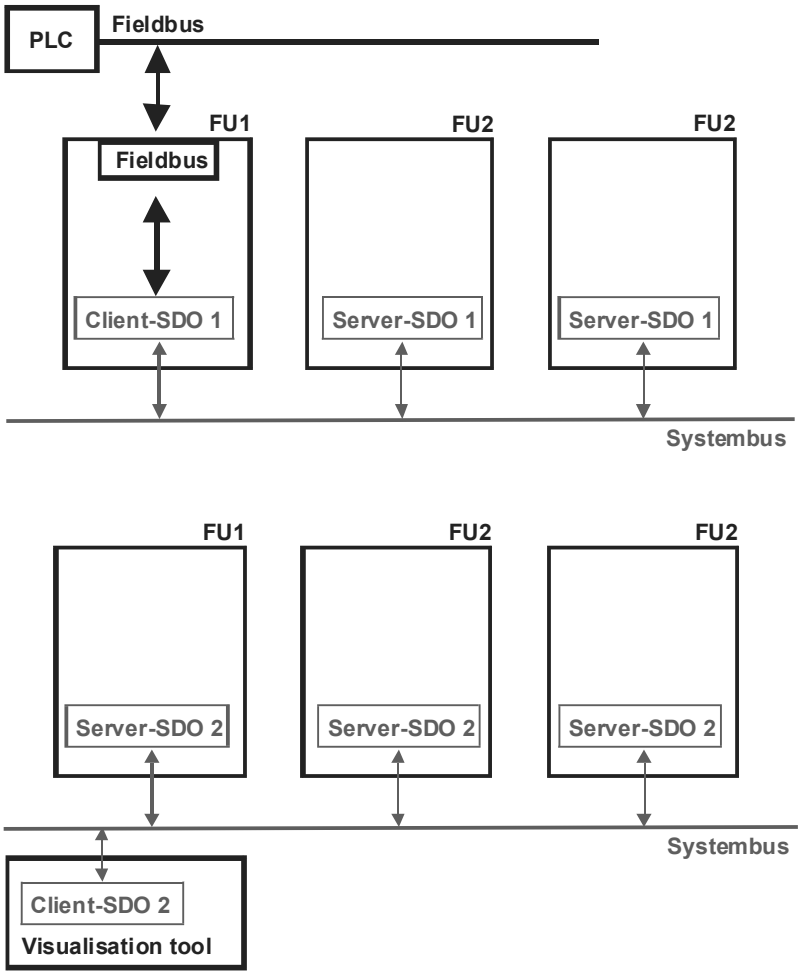
Resetting of SysbusEmergency is done with the fault acknowledgment.

7.3.4 Client-SDO (Systembus Master)

Each node on the Systembus can be addressed via the SDO channels. In this way, each node can be addressed and parameterized by one master via its client SDO1. All the parameters of the data types uint/int/long are accessible. String parameters cannot be processed. If a frequency inverter has been defined as a Systembus master, each node on the Systembus in this frequency inverter can be addressed by means of a field bus connection (RS232, RS485, Profibus-DP) via its client SDO1.

Attention!
The second SDO channel SDO2 of the frequency inverters is planned for the parameterization of the frequency inverters via a visualization tool on the Systembus.

The service used is SDO Segment Protocol Expedited according to CANopen. The frequency inverter defined as a Systembus master automatically generates the correct telegrams. If the SDO channel is operated via a PLC/PC on the Systembus, the telegrams must be generated according to the specification.



7.4 Slave Functionality

7.4.1 Boot-up Sequence, Network Management

7.4.1.1 Boot-up Message

After the initialization, each slave on the Systembus transmits its boot-up message (heartbeat message).

Note:
The boot-up telegram has the identifier 1792 + node ID and a data byte with contents = 0x00.

This telegram is of importance if a PLC/PC with CANopen functionality is used as a master. The frequency inverter defined as a Systembus master does **not** evaluate the boot-up message.

7.4.1.2 State Control

The identifier used for the NMT telegrams is "0" and may only be used by the Systembus master for NMT telegrams. The telegram contains two data bytes.

Byte 0	Byte 1
CS (Command Specifier)	Node-ID

Identifier = 0

With the specification of the Node-ID ≠ 0, the NMT command acts on the node selected via the Node-ID. If Node-ID = 0, all nodes are addressed.

Transition	Command	Command Specifier
(3),(6)	Start Remote Node	1
(4),(7)	Enter Pre-Operational	128
(5),(8)	Stop Remote Node	2
-	Reset Node	129
-	Reset Communication	130

Attention!
The reset node and reset communication command specified according to DS 301 lead to a change to Pre-Operational via Initialization in the frequency inverters. There is a new boot-up message.

After a slave has received the command "Start Remote Node", it activates the PDO channels and is ready for the exchange of process data.

7.4.2 Processing the SYNC-Telegram

If synchronous PDOs have been created in a frequency inverter, their processing is synchronized with the sync event. This can be either a SYNC telegram or an RxPDO telegram and is set via **1180** *Operation mode* Synchronization.

According to the Predefined Connection Set the identifier = 128.

If a PC or PLC is used as a master, the identifier of the SYNC telegrams can be adapted by parameterization on the frequency inverter. The identifier of the SYNC telegram must be set identically in all nodes on the Systembus.

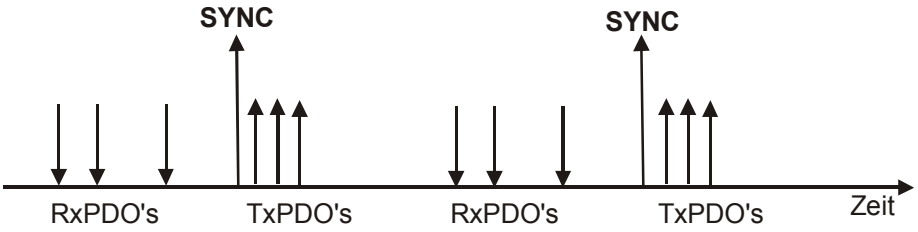
Attention!
The identifier range 129 ... 191 may not be used as the emergency telegrams can be found there.

The SYNC-Telegram Identifier is set via Parameter *SYNC-Identifier* **918**. See Chapter 7.3.2 "SYNC-Telegram Generation".

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
918	SYNC-Identifier	0	2047	0

The setting "0" results in identifier assignment according to the Predefined Connection Set.

The data of the RxPDOs are forwarded to the application after the arrival of the SYNC telegram. At the same time, the transmission of the TxPDOs with the currently available data from the application is triggered.



This method enables pre-occupancy of set points in the Systembus nodes and a synchronous / parallel take-over of the data.

7.4.3 Selecting Synrchonization source

The operating System (OS) of the frequency inverter can be synchronized to the PLC or other devices. The synchronization of the OS enhances the performance of the complete plant.

Synchronization via CANopen:

When using CANopen without Systembus, the synchronization can be switched on and off. Synchronization can be done with CANopen SYNC telegrams.

Synchronization via Systembus:

When using CANopen simultaneously with Systembus, the synchronization can be set to either CANopen, Systembus or it can be switched off. Synchronization can be done with Systembus SYNC telegrams or Systembus RxPDO telegrams.

Note: When synchronizing the OS via CANopen, the master has to support the synchronization mechanisms of CANopen.

OS_SyncSource **1452**	
Operation mode	**Function**
0 - Auto	The synchronization source is selected automatically by the inverter.
1 - CANopen	The OS is synchronized via CANopen. **Factory setting**.
2 - Systembus	The OS is synchronized via Systembus.
3 - off	The OS is not synchronized with other devices.

Operation mode **Auto**: The selection is done via this decision table:

CANopen active	**Systembus active**	**Synchronization**
Yes	Yes	➔ Synchronization via CANopen
Yes	No	
No	Yes	➔ Synchronization via Systembus
No	No	➔ No Synchronization activated.

The CANopen active status is recognized by the parameter setting **387** *CAN Node Number* >1 and a running synchronous PDO.

The Systembus active status is recognized by the parameter setting **900** *Systembus Node ID* >1. Also parameter **1180** *Synchronization* has to be set to SYNC or an RxPDO.

The Source of the OS Synchronization is selected with **1180** *Operation mode*.
This defines the Sync event (RxPDO or SYNC telegram), that is used for the Synchronization of the following PDO's:

930 *TxPDO1 Function*
932 *TxPDO2 Function*
934 *TxPDO3 Function*
936 *RxPDO1 Function*
937 *RxPDO2 Function*
938 *RxPDO3 Function*

Synchronization *Operation mode* **1180**	
Operation mode	**Function**
0 - Off	The synchronization via System bus is deactivated. **Factory setting**.
1 - RxPDO1	The synchronization via System bus is activated with RxPDO1.
2 - RxPDO2	The synchronization via System bus is activated with RxPDO2.
3 - RxPDO3	The synchronization via System bus is activated with RxPDO3.
10 - SYNC	The synchronization via System bus is activated with SYNC.

7.4.3.1 Scope sources

For the VPlus Scope Function the following sources are available for diagnosis:

Operation mode		Function
731 -	B: Sync. OS <-> Sysbus Ok	1 = Synchronization OS to Systembus OK, 0 = Synchronization OS to Systembus not OK
852-	SysBus SYNC time [us]	Shows the Synchronization cycle. Should show the set SYNC time or TxPDO time of the sending master.
853	SysBus SYNC position 1ms Task [us]	Shows the Synchronization time inside 1 ms. Should remain constant with small fluctuations.
854-	B: Sync. OS <-> CANopen Ok	1 = Synchronization OS to CANopen OK, 0 = Synchronization OS to CANopen not OK
848-	SYNC time [us]	Shows the Synchronization cycle. Should show the set SYNC time of object 0x1006.
849-	CANopen SYNC position 1ms Task [us]	Shows the Synchronization time inside 1 ms. Should remain constant with small fluctuations.

Please refer also to the CM-CAN manual when using the synchronization via CM-CAN.

7.4.4 Emergency Message, Fault Switch-off

As soon as a fault switch-off occurs in a slave frequency inverter, the emergency telegram is transmitted. The emergency telegram marks the node ID for the identification of the failed node via its identifier and the existing fault message via its data contents (8 bytes).

The Emergency-Telegram has the Identifier 128 + Node-ID.

After a fault acknowledgment, another emergency telegram is transmitted, with the data content (Byte 0 ...7) being set to zero this time. This identifies the node's repeated readiness for operation. If a further fault occurs subsequently, it is transmitted in a new emergency telegram.

The acknowledgment sequence is based on the definitions according to CANopen®.

Data content of the Emergency-Telegram:

Emergency Telegram		
Byte	**Value**	**Meaning**
0	0x00	low-byte Error-Code
1	0x10	high-byte Error-Code
2	0x80	Error-Register
3	0	-
4	0	-
5	0	-
6	0xnn	internal Error-Code, low-byte
7	0xmm	internal Error-Code, high-byte

Bytes 0, 1 and 2 are firmly defined and compatible with CANopen®.

Bytes 6/7 contain the product specific BONFIGLIOLI-VECTRON error code.

Error-Code = 0x1000 = general Error
Error-Register = 0x80 = manufacturer-specific error

7.4.5 Server-SDO1/SDO2

The communication channel for the exchange of parameter data is the SDO channel. Communication works according to the client/server model. The server is the node holding the data (here the frequency inverter), the client the node requesting or wanting to alter the data (PLC, PC or frequency inverter as Systembus master).

For the frequency inverter, two server SDO channels have been implemented.

The first SDO channel **SDO1** is used for the parameterization of the PLC/PC as a master or frequency inverter with field bus connection as a Systembus master.

The second SDO channel **SDO2** is reserved for a visualization tool for parameterization. An exchange of data can only be implemented by the master via a client SDO.

The SDO channels are stipulated for the server SDOs via identifiers according to the Predefined Connection Set of CANopen®. As CANopen® only provides for and defines one SDO channel in the Predefined Connection Set, the second SDO channel can be deactivated.

The number of Systembus nodes and the adjustable node ID is limited to 63.

Identifier assignment according to the Predefined Connection Set:

Identifier Rx-SDO = 1536 + Node-ID
(Node-ID = 1 ... 127, Identifier = 1537 ... 1663)
Identifier Tx-SDO = 1408 + Node-ID
(Node-ID = 1 ... 127, Identifier = 1409 ... 1535)

Identifier assignment for SDO1/SDO2 compatible with the Predefined Connection Set:

Identifier Rx-SDO1 = 1536 + Node-ID
(Node-ID = 1 ... 63, Identifier = 1537 ... 1599)
Identifier Tx-SDO1 = 1408 + Node-ID
(Node-ID = 1 ... 63, Identifier = 1409 ... 1471)

Identifier Rx-SDO2 = 1600 + Node-ID
(Node-ID = 0 ... 63, Identifier = 1600 ... 1663)
Identifier Tx-SDO2 = 1472 + Node-ID
(Node-ID = 0 ... 63, Identifier = 1472 ... 1535)

This corresponds to the factory settings of the frequency inverters for the SDOs.

The Node-ID = 0 for SDO2 is the Systembus Master.

Attention:
The SDO2 must be deactivated in a CANopen® system in order not to generate any compatibility problems.

If a frequency inverter has been defined as the Systembus master, the above settings for the SDO1 must be maintained in all the frequency inverters. In this way, access to the parameterization of the frequency inverters via a field bus connection on the master frequency inverter is possible.

The client SDO1 in the master frequency inverter addresses the server SDO1 of the slaves via the above identifiers.

Attention!
The identifiers for a visualization tool on the second SDO channel SDO2 cannot be changed.

If a PC or a PLC is used as a master, the identifiers of the Rx/Tx-SDO1 can be adapted by parameterization on the frequency inverter.

Attention!
In free assignment of identifiers, there may not be any double occupancy.

The identifier range 129...191 may not be used as the Emergency Telegrams can be found there.

- **921 RxSDO1-Identifier**

The setting of the RxSDO1 Identifier is carried out via Parameter *RxSDO1-Identifier* **921**.

Parameter		Setting		
Nr.	**Description**	**Min.**	**Max.**	**Factory Setting**
921	RxSDO1-Identifier	0	2047	0

- **922 TxSDO1-Identifier**

The setting of the TxSDO1 Identifier is carried out via Parameter *TxSDO1-Identifier* **922**.

Parameter		Setting		
Nr.	**Description**	**Min.**	**Max.**	**Factory Setting.**
922	TxSDO1-Identifier	0	2047	0

The setting "0" results in identifier assignment according to the Predefined Connection Set.

- **923 SDO2 Set Active**

The second SDO channel can be deactivated via Parameter *SDO2 Set Active* **923**.

SDO2 Set Active **923**	Function
0 - SDO2 deactivated	Communication channel deactivated
1 - SDO2 activated	Communication channel activated for the visualization tool

The identifier assignment for the second SDO channel is always according to the specification:

Identifier Rx-SDO2 = 1600 + Node-ID
Identifier Tx-SDO2 = 1472 + Node-ID

Note:
In this way, fixed identifiers via which communication takes place are available for the visualization tool.

7.5 Communication Channels, SDO1/SDO2

7.5.1 SDO-Telegram (SDO1/SDO2)

The service used for the exchange of parameter data is **SDO Segment Protocol Expedited**. The data (type uint, int, long) are exchanged in a telegram.

Access to the parameters in the frequency inverters with a statement of parameter number and data set is displayed via the addressing defined for object access pursuant to the specifications of CANopen via Index/Sub-Index.

Index = Parameter Number / Sub Index = Data Set

The data to be transmitted have a length of 2 bytes for uint/int and 4 bytes for long. For standardization and simplification, 4 bytes are always transmitted.

The data are in bytes 4...7 of the SDO telegram.

- uint/int variables are transmitted in bytes 4 and 5 with bytes 6 und 7 = 0.
- long variables are transmitted in bytes 4...7.

Writing Parameters:

Client ➔ Server SDO Download (expedited)

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Ctrl Byte	Parameter Number		Data Set	Data			
	LSB	MSB	0xnn	LSB			MSB
0x2B	uint/int			LSB	MSB	0x00	0x00
0x23	long			LSB	...	...	MSB

Server ➔ Client Download Response ➔ Writing process error-free

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Ctrl Byte	Parameter Number		Data Set	Data			
0x60	LSB	MSB	0xnn	0			

Server ➔ Client Abort SDO Transfer ➔ Error in Writing process

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Ctrl Byte	Parameter Number		Data Set	Data			
0x80	LSB	MSB	0xnn	Code	0	0	0

On an error in the writing process the error code is located in byte 4.

Attention!
Control byte 0x22 for the identification "SDO Download expedited" does not consider the bits "s" (data size indicated) and "n" (number of bytes not containing data). If set, they are ignored. The user is responsible for the number of bytes matching the type of data.

Reading Parameters:

Client ➔ Server SDO Upload (expedited)

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Ctrl Byte	Parameter Number		Data Set	Data			
0x40	LSB	MSB	0xnn	0			

Server ➔ Client Upload Response ➔ Reading process error-free

0	1	2	3	4	5	6	7
Ctrl Byte	Parameter Number		Data Set	Data			
	LSB	MSB	0xnn	LSB			MSB
0x4B	uint/int			LSB	MSB	0x00	0x00
0x43	long			LSB	...	...	MSB

Server ➔ Client Abort SDO Transfer ➔ Error in Reading process

0	1	2	3	4	5	6	7
Ctrl Byte	Parameter Number		Data Set	Data			
0x80	LSB	MSB	0xnn	Code	0	0	0

On an error in the writing process the error code is located in byte 4.

Error Codes	
Code	**Description**
1	invalid parameter value
2	invalid data set
3	parameter not readable
4	parameter not writeable
5	read error EEPROM
6	write error EEPROM
7	checksum error EEPROM
8	parameter cannot be written while drive is running
9	data set values differ
10	parameter has wrong type
11	unknown parameter
12	BCC-error in VECTRON-Bus-Protocol
15	unknown error
20	Systembus node not available only in access via field bus connection
21	string parameter not admissible only in access via VECTRON bus protocol

Errors marked in the table are generated by the field bus side, not in the Abort SDO Transfer of the Systembus.

7.5.2 Communication via Fieldbus Connection (SDO1)

If a frequency inverter has been defined as the Systembus master and equipped with a field bus interface, access to the parameterization of all the nodes in existence on the Systembus is possible by means of this field bus interface via the first SDO channel (SDO1). An extension has been created in the protocol frame of the field buses for this purpose.

Attention!
The prerequisite for this mechanism is that the identifier setting for the first SDO channel (SDO1) corresponds to the Predefined Connection Set.

The parameter addressed must also exist in the Systembus master.

7.5.2.1 Profibus-DP

If an object with communication channel (PKW) is used in Profibus-DP, access to all the other nodes on the Systembus can be done via it. The structure of the communication channel permits an additional addressing of a Systembus node. This is done by the use of an unused byte in the communication channel.

Alternatively, access can be carried out via the DP-V1 channel.

The functions are described in the Profibus-DP V1 user manual.

7.5.2.2 RS232/RS485 with VECTRON Bus Protocol

The functions are described in the VABus user manual.

7.6 Process Data Channels, PDO

7.6.1 Identifier Assignment for Process Data Channel

- **924 ... 929 RxPDO Identifier/TxPDO Identifier**

The process channel for the exchange of process data under CANopen® is the PDO channel. Up to three PDO channels with differing properties can be used in one device..

The PDO channels are defined via identifiers according to the Predefined Connection Set to CANopen:

Identifier 1. Rx-PDO = 512 + Node-ID
Identifier 1. Tx-PDO = 384 + Node-ID

Identifier 2. Rx-PDO = 768 + Node-ID
Identifier 2. Tx-PDO = 640 + Node-ID

Identifier 3. Rx-PDO = 1024 + Node-ID
Identifier 3. Tx-PDO = 896 + Node-ID

This corresponds to the factory settings of the frequency inverters for the Rx/Tx-PDOs. This occupancy is aligned to an external master (PLC/PC) serving all the channels.

If the PDO channels are used for a connection of the frequency inverters amongst one another, the identifiers are to be set accordingly by parameterization.

Attention!
In free assignment of identifiers, there may not be any double occupancy!

The identifier range 129...191 may not be used as the emergency telegrams can be found there.

Setting the Rx/TxPDO Identifiers:

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
924	RxPDO1 Identifier	0	2047	0
925	TxPDO1 Identifier	0	2047	0
926	RxPDO2 Identifier	0	2047	0
927	TxPDO2 Identifier	0	2047	0
928	RxPDO3 Identifier	0	2047	0
929	TxPDO3 Identifier	0	2047	0

The setting "0" results in identifier assignment according to the Predefined Connection Set.

7.6.2 Process Data Channel Operation Modes

- **931 TxPDO1 Time**
- **933 TxPDO2 Time**
- **935 TxPDO3 Time**

The transmit/receive behavior can be time controlled or controlled via a Sync event (SYNC telegram or RxPDO telegram). The behavior can be parameterized for each PDO channel.

Tx-PDOs can work time controlled or Sync controlled. A time controlled TxPDO transmits its data at the interval of time set. A SYNC controlled TxPDO transmits its data after the arrival of a Sync event.

RxPDOs in the time controlled setting forward the received data to the application immediately. If an RxPDO is Sync controlled, it forwards its received data to the application after the arrival of the Sync telegram.

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
931	TxPDO1 Time	1 ms	50000 ms	8 ms
933	TxPDO2 Time	1 ms	50000 ms	8 ms
935	TxPDO3 Time	1 ms	50000 ms	8 ms

The behavior of the TxPDOs is set with the following parameters:
TxPDO1 Function **930**, *TxPDO2 Function* **932** and *TxPDO3 Function* **934**.
See Chapter 7.2.2 "PDO-Channels (Process Data)".

Operation Mode	Function
0 - Not active	No data are sent
1 - Controlled by time	The data are sent in the cycle of the set time interval
2 - Controlled by SYNC	The data are sent after arrival of the SYNC-Telegram

The behavior of the RxPDOs is set with the following parameters:
RxPDO1 Function **936**, *RxPDO2 Function* **937** und *RxPDO3 Function* **938**.
See Chapter 7.2.2 "PDO-Channels (Process Data)".

Operation Mode	Function
0 - Controlled by time	The received data is passed on immediately.
1 - Controlled by SYNC	The received data is passed on, on arrival of the SYNC-Telegram.

Note:
In the operation mode "Controlled by time", the received data is polled with a sampling rate of 1 ms.

7.6.3 Process Data Channel Timeout Monitoring

- **939 SYNC Timeout**
- **941 RxPDO1 Timeout**
- **942 RxPDO2 Timeout**
- **945 RxPDO3 Timeout**

Each frequency inverter monitors its received data for whether they are updated within a defined time window.
The monitoring is carried out on the SYNC message and the RxPDO channels.

Parameter		Setting		
No.	**Description**	**Min.**	**Max.**	**Factory Setting**
939	SYNC Timeout	0 ms	60000 ms	0 ms
941	RxPDO1 Timeout	0 ms	60000 ms	0 ms
942	RxPDO2 Timeout	0 ms	60000 ms	0 ms
945	RxPDO3 Timeout	0 ms	60000 ms	0 ms

Setting 0 means no timeout monitoring.

Attention!
Monitoring for the SYNC-Telegram is only carried out if at least one RxPDO or one TxPDO is defined as SYNC-controlled.

If a timeout period is exceeded, the frequency inverter shuts down and reports one of the faults:

F2200 Systembus Timeout SYNC

F2201 Systembus Timeout RxPDO1
F2202 Systembus Timeout RxPDO2
F2203 Systembus Timeout RxPDO3

7.6.4 Communication Relationships of the Process Data Channel

Regardless of the process data to be transmitted, the communication relationships of the process data channels must be defined. The connection of PDO channels is done via the assignment of the identifiers. The identifiers of Rx-/Tx-PDO must match in each case.

There are two possibilities:

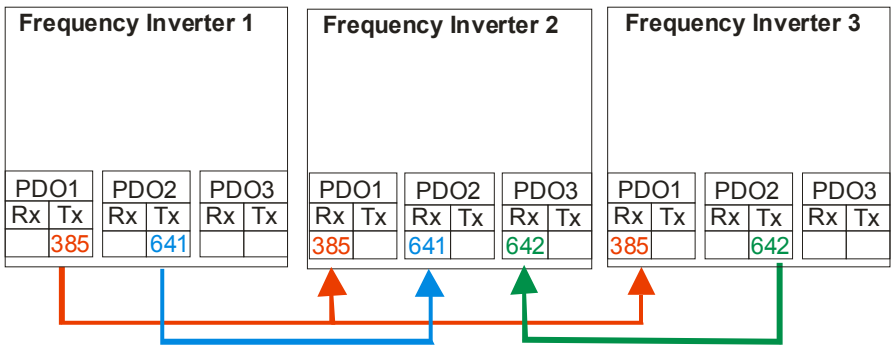
- connect one Rx-PDO to one Tx-PDO (one to one)
- connect several Rx-PDOs to one TxPDO (one to many)

This process is documented in tabular form in a communication relationship list:

Example:

Frequency Inverter 1		**Frequency Inverter 2**		**Frequency Inverter 3**	
PDO	Identifier	PDO	Identifier	PDO	Identifier
TxPDO1	**385**	TxPDO1		TxPDO1	
RxPDO1		**RxPDO1**	**385**	**RxPDO1**	**385**
TxPDO2	**641**	TxPDO2		**TxPDO2**	**642**
RxPDO2		**RxPDO2**	**641**	RxPDO2	
TxPDO3		TxPDO3		TxPDO3	
RxPDO3		**RxPDO3**	**642**	RxPDO3	

Attention!
All TxPDOs used must have different identifiers!
The identifier must be unique within the Systembus network.



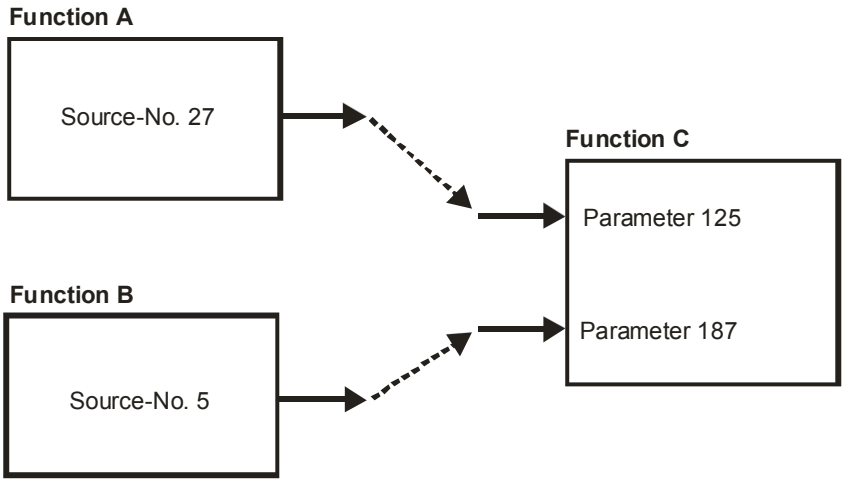
7.6.5 Virtual Links

According to CANopen® a PDO telegram contains 0...8 data bytes. A mapping to any type of object can be made in these data bytes.

For the Systembus, PDO telegrams have a fixed number of 8 data bytes. The mapping is carried out not as in CANopen® via Mapping-Parameters, but with the method of sources and links.

Each function provides its output data via a source. These sources are defined via source numbers. The input data of functions are defined via parameters. The link of a data input to a data output is done via the assignment of parameters to source numbers.

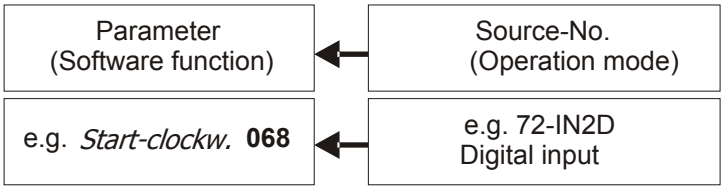
Example 1:



In example 1, the two inputs of function C are connected with the outputs of functions A and B. Thus, the parameterization for this connection is:

Function C
Parameter 125 = Source-No. 27
Parameter 187 = Source-No. 5

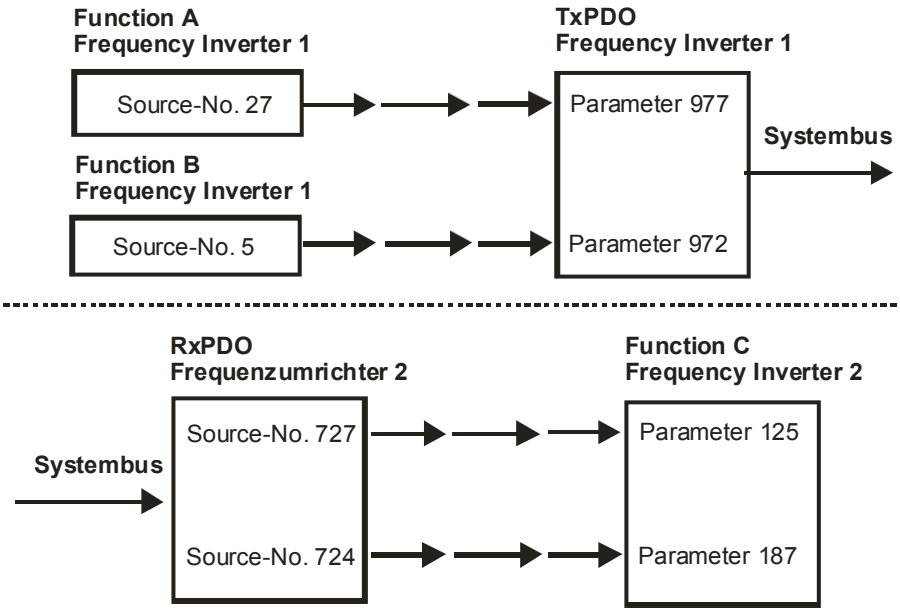
Example of a virtual link in VPlus:



The assignment of the operation modes to the software functions available can be adapted to the application in question.

For the Systembus, the input data of the TxPDOs are also displayed as input parameters and the output data of the RxPDOs as sources.

Example 2:



Example 2 displays the same situation as Example 1. But now, the functions A and B are in frequency inverter 1 and function C in frequency inverter 2. The connection is done via a TxPDO in frequency inverter 1 and a RxPDO in frequency inverter 2. Thus, the parameterization for this connection is:

Frequency Inverter 1
Parameter 977 = Source-No. 27
Parameter 972 = Source-No. 5

Frequency Inverter 2
Parameter 125 = Source-No. 727
Parameter 187 = Source-No. 724

As the links with the system used exceed the device limits, they are termed "virtual links".

The virtual links with the possible sources are related to the Rx/TxPDO channels. For this purpose, the eight bytes of the Rx-/TxPDOs are defined structured as inputs and sources. This exists for each of the three PDO channels.

Each Transmit-PDO und Receive-PDO can be occupied as follows:

4 Boolean Variables

or

4 uint/int Variables

or

2 long Variables

or

a combination taking the available 8 bytes into respect

Assignment of Data Type to No. of Bytes:

Assignment	
Data Type	**Length**
Boolean	2 Bytes
uint/int	2 Bytes
long	4 Bytes

7.6.5.1 Input Parameters of the TxPDOs for Data to be sent

- **946 ... 955 TxPDO1**
- **956 ... 965 TxPDO2**
- **966 ... 977 TxPDO3**

The listed parameters can be used to stipulate the data that are to be transported there for each position in the TxPDO telegrams. The setting is done in such a way that a source number is entered for the required data in the parameters.

TxPDO1 Byte	P.-No. Boolean-Input	TxPDO1 Byte	P.-No. uint/int-Input	TxPDO1 Byte	P.-No. long-Input
0	**946** Boolean1	0	**950** Word1	0	**954** Long1
1		1		1	
2	**947** Boolean2	2	**951** Word2	2	
3		3		3	
4	**948** Boolean3	4	**952** Word3	4	**955** Long2
5		5		5	
6	**949** Boolean4	6	**953** Word4	6	
7		7		7	

TxPDO2 Byte	P.-No. Boolean-Input	TxPDO2 Byte	P.-No. uint/int-Input	TxPDO2 Byte	P.-No. long-Input
0	**956** Boolean1	0	**960** Word1	0	**964** Long1
1		1		1	
2	**957** Boolean2	2	**961** Word2	2	
3		3		3	
4	**958** Boolean3	4	**962** Word3	4	**965** Long2
5		5		5	
6	**959** Boolean4	6	**963** Word4	6	
7		7		7	

TxPDO3 Byte	P.-No. Boolean-Input	TxPDO3 Byte	P.-No. uint/int-Input	TxPDO3 Byte	P.-No. long-Input
0	**966** Boolean1	0	**972** Word1	0	**976** Long1
1		1		1	
2	**967** Boolean2	2	**973** Word2	2	
3		3		3	
4	**968** Boolean3	4	**974** Word3	4	**977** Long2
5		5		5	
6	**969** Boolean4	6	**975** Word4	6	
7		7		7	

Note:
Depending on the selected data information the percentages values are displayed via the uint/int inputs.

With this method, there are up to three possibilities for a meaning of the contents of the individual bytes. Each byte may only be used for one possibility.

To ensure this, the processing of the input links is derived from the setting.
If an input link has been set to the fixed value of zero, it is not processed.

The settings fort he fixed value zero are:

Source = 7 (FALSE) for boolean variables
Source = 9 (0) for uint, int, long variables

This is the factory setting.

Examples of Boolean-Sources

Boolean-Source	
Source	**Data**
6	TRUE
7	FALSE
71	Contact Input 1
72	Contact Input 2
73	Contact Input 3
161	Running Message
163	Reference value reached
164	Set Frequency reached (P. 510)

Examples of uint/int-Sources

unit/int-Source	
Source	**Data**
9	0
63	Reference Percentage 1
64	Reference Percentage 2
52	Analog Input MFI1A
133	Output Percentage Ramp
137	Output Reference Percentage Channel
138	Output Actual Percentage Channel
740	Control Word
741	Status Word

Examples of long-Sources

long-Source	
Source	**Data**
9	0
0	Output Frequency Ramp
1	Fixed Frequency 1
5	Reference Line Value
62	Output Frequency Reference Value Channel
50	Analog Reference Value MFI1A

7.6.5.2 Source-Numbers of RxPDOs for received Data

Equivalent to the input links of the TxPDOs, the received data of the RxPDOs are displayed via sources or source numbers. The sources existing in this way can be used in the frequency inverter via the local input links for the data targets.

RxPDO1 Byte	Source-No. Boolean-Value	RxPDO1 Byte	Source-No. uint/int-Value	RxPDO1 Byte	Source-No. long-Value
0	**700** Boolean1	0	**704** Word1	0	**708** Long1
1		1		1	
2	**701** Boolean2	2	**705** Word2	2	
3		3		3	
4	**702** Boolean3	4	**706** Word3	4	**709** Long2
5		5		5	
6	**703** Boolean4	6	**707** Word4	6	
7		7		7	

RxPDO2 Byte	Source-No. Boolean-Value	RxPDO2 Byte	Source-No. uint/int-Value	RxPDO2 Byte	Source-No. long-Value
0	**710** Boolean1	0	**714** Word1	0	**718** Long1
1		1		1	
2	**711** Boolean2	2	**715** Word2	2	
3		3		3	
4	**712** Boolean3	4	**716** Word3	4	**719** Long2
5		5		5	
6	**713** Boolean4	6	**717** Word4	6	
7		7		7	

RxPDO3 Byte	Source-No. Boolean-Value	RxPDO3 Byte	Source-No. uint/int-Value	RxPDO3 Byte	Source-No. long-Value
0	**720** Boolean1	0	**724** Word1	0	**728** Long1
1		1		1	
2	**721** Boolean2	2	**725** Word2	2	
3		3		3	
4	**722** Boolean3	4	**726** Word3	4	**729** Long2
5		5		5	
6	**723** Boolean4	6	**727** Word4	6	
7		7		7	

With this method, there are up to three possibilities for a meaning of the contents of the individual bytes. Each byte may only be used for one possibility.

Note:
Depending on the selected data information the percentages values are displayed via the uint/int inputs.

7.6.5.3 Examples of Virtual Links

Example 1:

Frequency Inverter 1				Frequency Inverter 2		
Source -No.	**Input Link**	**TxPDO1 Byte**		**RxPDO1 Byte**	**Source-No.**	**Target**
Control Word **740**	950	0	→	0	704	Control Input-Control Word **99**
		1		1		
		2		2		
		3		3		
Output Reference-Frequency Channel **62**	955	4	→	4	709	Ramp Input, Line Value **137**
		5		5		
		6		6		
		7		7		

Parameter 950 = Source-No. 740
Parameter 955 = Source-No. 62

Parameter 99 = Source-No. 704
Parameter 137 = Source-No. 709

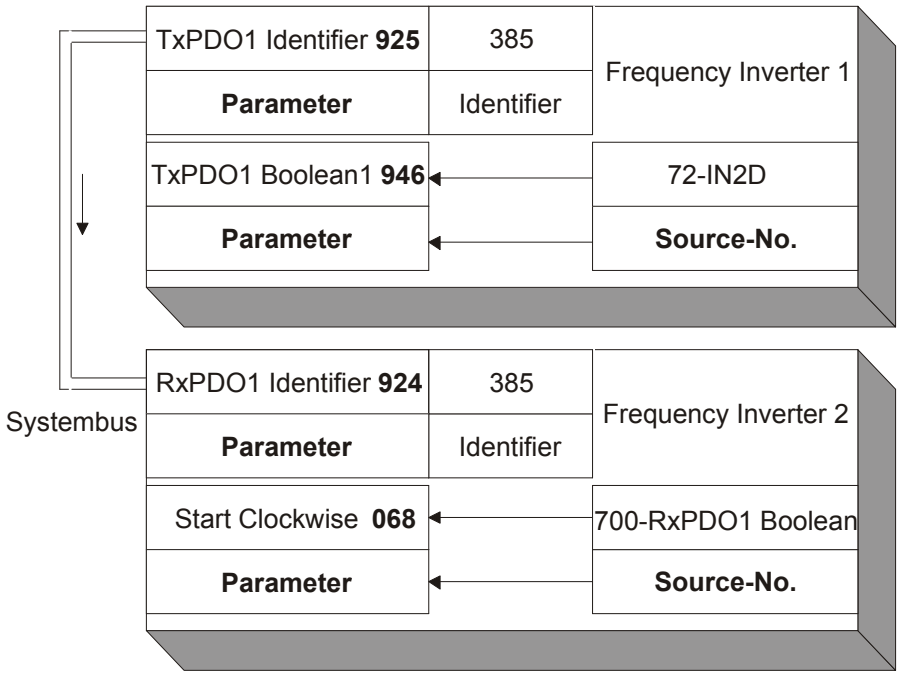
The control word of frequency inverter 1 is linked with the control word of frequency inverter 2. In this way, both frequency inverters can be operated synchronously via the remote control. The output of the reference value channel of frequency inverter 1 is laid onto the output of the ramp of frequency inverter 2. In this way, both frequency inverters have a joint source of reference values and are given reference values in the internal notation.

As an extension, a number of frequency inverters can also exist on the receive side (Rx), these then being supplied with data parallel and simultaneously.

The input link not used in the TxPDO1 of frequency inverter 1 is on ZERO and is thus not served.

Example 2:

Example of a virtual link with transmission via the Systembus:



7.7 Control Parameters

- **978 Node-State**
- **979 CAN-State**

For the monitoring of the Systembus and the display of the internal states, two control parameters are provided. There is a report of the Systembus state and a report of the CAN state via two actual value parameters.

Parameter *Node-State* **978** gives information about the Pre-Operational, Operational, Stopped state. A PDO transfer is only possible in the Operational state. The state is controlled by the Systembus master (PLC / PC / frequency inverter) via NMT telegrams.

Parameter *CAN-State* **979** gives information about the state of the physical layer. If there are transmission errors, the state changes from OKAY to WARNING until the cancellation of the communication with BUS-OFF. After BUS-OFF, the CAN controller is automatically re-initialized and the Systembus started again.

Note:
if the BUS-OFF state occurs, the frequency inverter shuts down with "F2210 BUS-OFF".

After Bus-OFF, the Systembus in the frequency inverter is completely reinitialized. There is a new boot-up message from the node and an emergency telegram with the Bus-OFF message is transmitted. The change of state of the node to Operational is done by the Start-Remote-Node telegram cyclically sent by the Systembus master.

Actual Values of the Systembus

No.	Description	Function
978	Node-State	1 - Pre-Operational 2 - Operational 3 - Stopped
979	CAN-State	1 - OKAY 2 - WARNING 3 - BUS-OFF

7.8 Handling of Systembus Parameters

The actual value parameters for the system state and bus state can be observed in the "Actual" menu of the operator panel or with the VPlus PC-Software.

Note:
The Systembus parameters are on control level 3 and are thus available for the user at any time.

Note:
In the operator panel only parameter *Node-ID* **900** is visible at first. Only when a Node ID > -1 is set, further Systembus parameters are visible.

Attention!
If a communication module for fieldbus connection (CM-232, CM-485 or CM-PDP) is installed on a frequency inverter, then the parameterization can be carried out via the X21 Connection. For the connection of the frequency inverter to a USB-Connection of a PC, an interface adapter must be installed.

The display of the parameters when using the XPI file is according to the following structure:

Systembus

Basic Settings	900 Node-ID 903 Baud-Rate
Master Functions	904 Boot-Up Delay 919 SYNC-Time
SYNC-Identifier	918 SYNC-Identifier
SDO1-Identifier	921 RxSDO1-Identifier 922 TxSDO1-Identifier
SDO2 Set Active	923 SDO2 Set Active
PDO-Identifier	924 RxPDO1-Identifier 925 TxPDO1-Identifier 926 RxPDO2-Identifier 927 TxPDO2-Identifier 928 RxPDO3-Identifier 929 TxPDO3-Identifier
TxPDO-Function	930 TxPDO1 Function 931 TxPDO1 Time 932 TxPDO2 Function 933 TxPDO2 Tome 934 TxPDO3 Function 935 TxPDO3 Time
RxPDO-Function	936 RxPDO1 Function 937 RxPDO2 Function 938 RxPDO3 Function
Timeout	939 SYNC Timeout 941 RxPDO1 Timeout 942 RxPDO2 Timeout 945 RxPDO3 Timeout
TxPDO1 Objects	946 TxPDO1 Boolean1 947 TxPDO1 Boolean2 948 TxPDO1 Boolean3 949 TxPDO1 Boolean4 950 TxPDO1 Word1 951 TxPDO1 Word2 952 TxPDO1 Word3 953 TxPDO1 Word4 954 TxPDO1 Long1 955 TxPDO1 Long2
TxPDO2 Objects	956 TxPDO2 Boolean1 957 TxPDO2 Boolean2 958 TxPDO2 Boolean3 959 TxPDO2 Boolean4 960 TxPDO2 Word1 961 TxPDO2 Word2 962 TxPDO2 Word3 963 TxPDO2 Word4 964 TxPDO2 Long1 965 TxPDO2 Long2
TxPDO3 Objects	966 TxPDO3 Boolean1 967 TxPDO3 Boolean2 968 TxPDO3 Boolean3 969 TxPDO3 Boolean4 972 TxPDO3 Word1 973 TxPDO3 Word2 974 TxPDO3 Word3 975 TxPDO3 Word4 976 TxPDO3 Long1 977 TxPDO3 Long2

Actual values

Systembus	978 Node-State 979 CAN-State

7.9 Synchronisation

- **1180 Operation Mode**

Operation Mode **1180**	Function
0 - Aus	No evaluation of SYNC-Message.
1 - RxPDO1	RxPDO1 is used as the SYNC-Message.
2 - RxPDO2	RxPDO2 is used as the SYNC-Message.
3 - RxPDO3	RxPDO3 is used as the SYNC-Message.
10 - SYNC	SYNC is used as the SYNC-Message.

Parameter *Operation Mode* **1180** determines which message is used as the SYNC-Message on the Systembus.

The selected message is used

- for the synchronisation of the operating system (if the "Systembus" setting is selected for Parameter *OS_SyncSource* **1452**) and
- for the processing of the synchronous PDOs on the Systembus (if set in Parameters 930, 932, 934, 936-938).

7.10 Utilities

For the planning of the Systembus according to the drive tasks in question, there are utilities in the form of tables.

The planning of the Systembus is carried out in three steps:

- Definition of the communication relationships
- Creation of the virtual links
- Capacity planning of the Systembus

The priority assignment of the identifiers is relevant for the definition of the communication relationships. Data that are to be transmitted with a higher priority must be given low identifiers. This results in the message with the higher priority being transmitted first with a simultaneous access of two nodes to the bus.

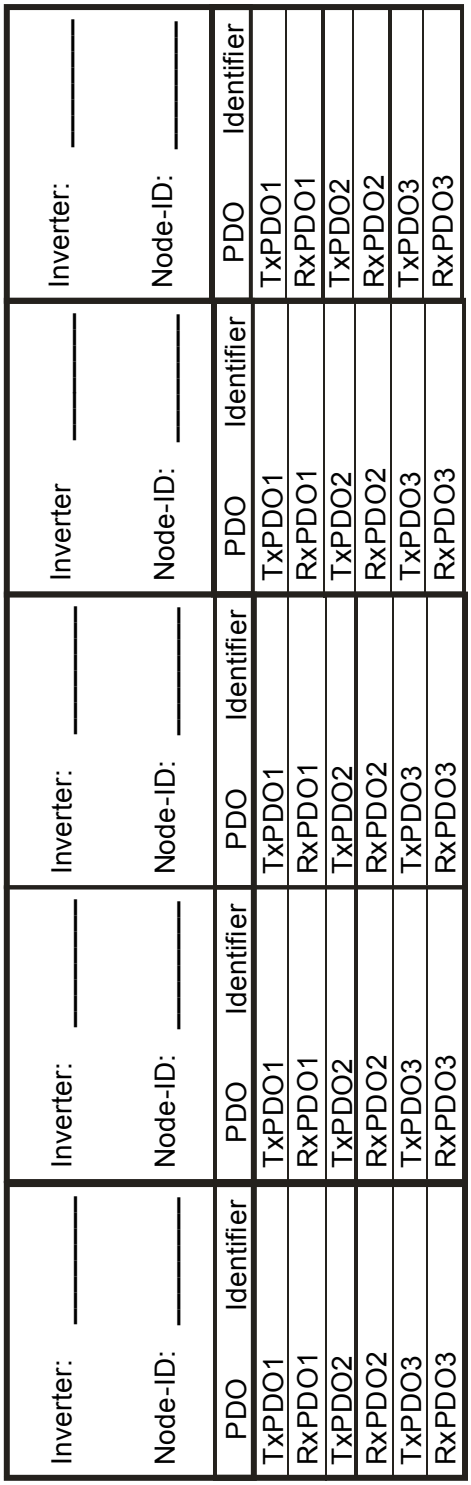
Note:
The recommended identifier range for the communication relationships via the PDO channels is 385 ... 1407.

The recommended identifier range for the communication relationships via the PDO channels is 385 ... 1407.

The identifiers above 1407 are used for the SDO channel for parameterization.

7.10.1 Definition of the Communication Relationships

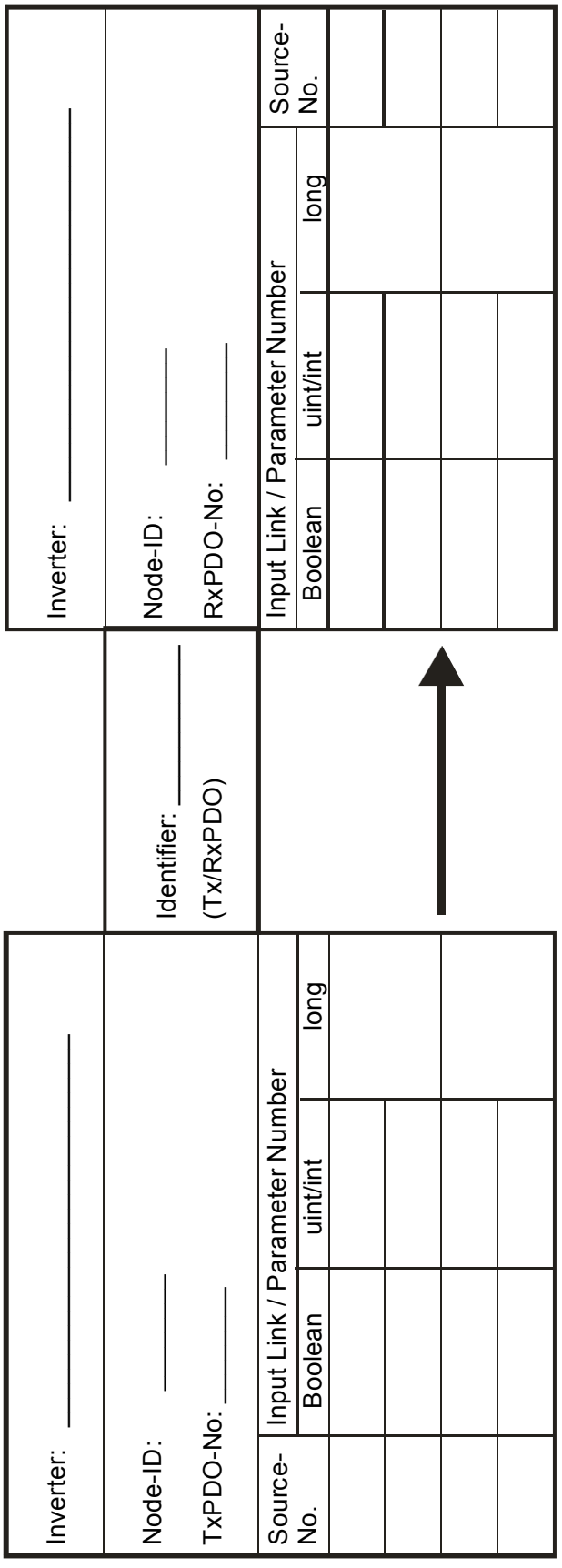
The communication relationships can be planned and documented with the help of the following table:



Inverter: _____ Node-ID: _____		Inverter: _____ Node-ID: _____		Inverter: _____ Node-ID: _____		Inverter: _____ Node-ID: _____	
PDO	Identifier	PDO	Identifier	PDO	Identifier	PDO	Identifier
TxPDO1		TxPDO1		TxPDO1		TxPDO1	
RxPDO1		RxPDO1		RxPDO1		RxPDO1	
TxPDO2		TxPDO2		TxPDO2		TxPDO2	
RxPDO2		RxPDO2		RxPDO2		RxPDO2	
TxPDO3		TxPDO3		TxPDO3		TxPDO3	
RxPDO3		RxPDO3		RxPDO3		RxPDO3	

7.10.2 Creation of the Virtual Links

The virtual links can be planned and documented with the help of the following table:



7.10.3 Capacity Planning of the Systembus

Each PDO telegram possesses a constant useful data content of 8 Bytes. According to worst case, this results in a maximum telegram length of 140 bits. The maximum telegram run time of the PDOs is thus stipulated via the set baud rate.

Capacity Planning	
Baud rate / kBaud	**Telegram run time / µs**
1000	140
500	280
250	560
125	1120
100	1400
50	2800

Depending on the set baud rate and the chosen transmission interval of the TxPDOs, the following bus loads result:

Systembus Capacity										
Baud rate	**Bus load depending on the transmission for one TxPDO in %**									
(kBaud)	**1ms**	**2ms**	**3ms**	**4ms**	**5ms**	**6ms**	**7ms**	**8ms**	**9ms**	**10ms**
1.000	14	7	4,7	3,5	2,8	2,3	2	1,8	1,6	1,4
500	28	14	9,3	7	5,6	4,7	4	3,5	3,1	2,8
250	56	28	18,7	14	11,2	9,3	8	7	6,2	5,6
125	112	56	37,3	28	22,4	18,7	16	14	12,4	11,2
100	140	70	46,7	35	28	23,3	20	17,5	15,6	14
50	280	140	93,3	70	56	46,7	40	35	31,1	28

Attention!
A bus load >100% means that a telegram cannot be dispatched completely between two transmission times. This setting is not admissible.

This observation must be done for each TxPDO. The sum of all the TxPDOs decides on the entire bus load. The bus load must be designed in such a way that any telegram repetitions for transmission errors are possible without exceeding the bus capacity.

Note:
To facilitate capacity planning, a Microsoft Excel file with the name "Load_Systembus.xls" is available.

The capacity planning can be carried out and documented with the help of the following table:

Systembus Load

Baud rate [kBaud]: 50, 100, 125, 250, 500, 1000	1000

Frequency Inverter	**TxPDO Number**	**Ta [ms]**	**Load [%]**
1	1	0	0
	2	0	0
	3	0	0
2	1	0	0
	2	0	0
	3	0	0
3	1	0	0
	2	0	0
	3	0	0
4	1	0	0
	2	0	0
	3	0	0
5	1	0	0
	2	0	0
	3	0	0
6	1	0	0
	2	0	0
	3	0	0
7	1	0	0
	2	0	0
	3	0	0
8	1	1	14
	2	1	14
	3	1	14
9	1	1	14
	2	1	14
	3	0	0
10	1	0	0
	2	0	0
	3	0	0
Total Load [%]			70

In the table, the set baud rate is entered from the parameter *Baud-Rate* **903** in kBaud. For each frequency inverter, the set time for the transmission interval (e. g. *TxPDO1 Time* **931**) in ms is entered for the TxPDO being used at the time. In the column **Load** the bus load caused by the individual TxPDO appears, under **Total Load** the entire bus load.

The following limits have been defined for the total bus load (Total Load):

≤ 80% OKAY
80 ... 90% CRITICAL
> 90% NOT POSSIBLE

8 Actual Values

Actual Values		
No.	**Description**	**Function**
978	Node-State	Systembus Node state. See Chapter 7.7 "Control Parameters".
979	CAN-State	Systembus CAN state. Siehe Kapitel 7.7 "Control Parameters".

9 Annex

9.1 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 Field bus.

Warning Messages		
Bit-No.	**Warning Code**	**Description**
0	0x0001	Warning Ixt
1	0x0002	Warning Short Term - Ixt
2	0x0004	Warning Long Term - Ixt
3	0x0008	Warning Heat Sink Temperature Tk
4	0x0010	Warning Inside Temperature
5	0x0020	Warning Limit
6	0x0040	Warning Init
7	0x0080	Warning Motor Temperature
8	0x0100	Warning Mains 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
14	0x4000	Warning Udc
15	0x8000	Warning Application

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

9.2 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 Field bus.

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

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

9.3 Error Messages

CANopen			
F20	21	CAN Bus-OFF	
	22	CAN Guarding	
	23	Error state	
	24	SYNC error (SYNC timing)	
	25	CAN NMT error	
	26	RxPDO1 length error	No. of received bytes different to mapping.
	27	RxPDO2 length error	
	28	RxPDO3 length error	
F23	nn	CAN Heartbeat, nn = Node-ID of the shut-down Node (hex)	
Systembus			
F22	00	Systembus Communication Error, Timeout Sync	
	01	Systembus Communication Error, Timeout RxPDO1	
	02	Systembus Communication Error, Timeout RxPDO2	
	03	Systembus Communication Error, Timeout RxPDO3	
	10	Bus-OFF	
Optional Components			
F0B	13	The installation of a communication module was carried out without disconnection from the power supply. Switch off the power supply.	

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.
In addition to the fault messages stated, there are further fault messages used for internal purposes only and which are not listed here. If you receive any fault messages which are not listed, please contact us by phone.

10 Parameter Lists

The parameter is available in the four data sets.

10.1 Actual Values ("Actual" Menu)

Actual Parameters				
No.	**Description**	**Unit**	**Value Range**	**Chapter**
Systembus				
260	Actual Error		0 ... 0xFFFF	9.3
270	Warnings		0 ... 0xFFFF	9.1
274	Application Warnings		0 ... 0xFFFF	9.2
411	Status word		0 ... 0xFFFF	6.1
978	Node-State	-	1 ... 3	8
979	CAN-State	-	1 ... 3	8

10.2 Parameters ("Para" Menu)

Parameters				
No.	**Description**	**Unit**	**Value Range**	**Chapter**
CANopen/CAN Systembus				
276	CAN Interface (CM-CAN/X12)	-	Selection	5.4
Bus Control				
410	Control Word	-	Selection	6.1
412	Local/Remote	-	Selection	6.1
414	Data set selection	-	0...5	6.1
Reference value				
484	Reference Frequency RAM	Hz	-999,99 ... 999,99	6.1
524	Reference Percentage RAM	%	-300,00 ... 300,00	6.1
Systembus				
900	Node-ID	-	-1 ... 63	6.3
903	Baud-Rate	-	Selection	6.2
904	Boot-Up Delay	ms	3500 ... 50000	7.3.1
918	SYNC-Identifier	-	0 ... 2047	7.3.2
919	SYNC-Time	ms	0 ... 50000	7.3.2
921	RxSDO1-Identifier	-	0 ... 2047	7.4.4
922	TxSDO1-Identifier	-	0 ... 2047	7.4.4
923	SDO2 Set Active	-	Selection	7.4.4
924	RxPDO1-Identifier	-	0 ... 2047	7.6.1
925	TxPDO1-Identifier	-	0 ... 2047	7.6.1
926	RxPDO2-Identifier	-	0 ... 2047	7.6.1
927	TxPDO2-Identifier	-	0 ... 2047	7.6.1
928	RxPDO3-Identifier	-	0 ... 2047	7.6.1
929	TxPDO3-Identifier	-	0 ... 2047	7.6.1
930	TxPDO1 Function	-	Selection	7.2.2
931	TxPDO1 Time	ms	0 ... 50000	7.6.2
932	TxPDO2 Function	-	Selection	7.2.2
933	TxPDO2 Time	ms	0 ... 50000	7.6.2
934	TxPDO3 Function	-	Selection	7.2.2
935	TxPDO3 Time	ms	0 ... 50000	7.6.2
936	RxPDO1 Function	-	Selection	7.2.2
937	RxPDO2 Function	-	Selection	7.2.2
938	RxPDO3 Function	-	Selection	7.2.2

Parameters				
No.	**Description**	**Unit**	**Value Range**	**Chapter**
939	SYNC Timeout	ms	0 ... 60000	7.6.3
941	RxPDO1 Timeout	ms	0 ... 60000	7.6.3
942	RxPDO2 Timeout	ms	0 ... 60000	7.6.3
945	RxPDO3 Timeout	ms	0 ... 60000	7.6.3
946	TxPDO1 Boolean1	-	Selection	7.6.5.1
947	TxPDO1 Boolean2	-	Selection	7.6.5.1
948	TxPDO1 Boolean3	-	Selection	7.6.5.1
949	TxPDO1 Boolean4	-	Selection	7.6.5.1
950	TxPDO1 Word1	-	Selection	7.6.5.1
951	TxPDO1 Word2	-	Selection	7.6.5.1
952	TxPDO1 Word3	-	Selection	7.6.5.1
953	TxPDO1 Word4	-	Selection	7.6.5.1
954	TxPDO1 Long1	-	Selection	7.6.5.1
955	TxPDO1 Long2	-	Selection	7.6.5.1
956	TxPDO2 Boolean1	-	Selection	7.6.5.1
957	TxPDO2 Boolean2	-	Selection	7.6.5.1
958	TxPDO2 Boolean3	-	Selection	7.6.5.1
959	TxPDO2 Boolean4	-	Selection	7.6.5.1
960	TxPDO2 Word1	-	Selection	7.6.5.1
961	TxPDO2 Word2	-	Selection	7.6.5.1
962	TxPDO2 Word3	-	Selection	7.6.5.1
963	TxPDO2 Word4	-	Selection	7.6.5.1
964	TxPDO2 Long1	-	Selection	7.6.5.1
965	TxPDO2 Long2	-	Selection	7.6.5.1
966	TxPDO3 Boolean1	-	Selection	7.6.5.1
967	TxPDO3 Boolean2	-	Selection	7.6.5.1
968	TxPDO3 Boolean3	-	Selection	7.6.5.1
969	TxPDO3 Boolean4	-	Selection	7.6.5.1
972	TxPDO3 Word1	-	Selection	7.6.5.1
973	TxPDO3 Word2	-	Selection	7.6.5.1
974	TxPDO3 Word3	-	Selection	7.6.5.1
975	TxPDO3 Word4	-	Selection	7.6.5.1
976	TxPDO3 Long1	-	Selection	7.6.5.1
977	TxPDO3 Long2	-	Selection	7.6.5.1
989	Emergency Reaction	-	Selection	7.3.3
1180	Operation mode	-	Selection	7.9
1452	OS_SyncSource	-	Selection	7.9

Index

Bonfiglioli

power, control and green solutions

Bonfiglioli has been designing and developing innovative and reliable power transmission and control solutions for industry, mobile machinery and renewable energy applications since 1956.

www.bonfiglioli.com

Bonfiglioli Riduttori S.p.A.
Via Giovanni XXIII, 7/A
40012 Lippo di Calderara di Reno
Bologna, Italy

tel: +39 051 647 3111
fax: +39 051 647 3126
bonfiglioli@bonfiglioli.com
www.bonfiglioli.com

VEC 696 R0