

RS485 - connection VCI-485

for static frequency inverters VCB 400



S10

Installation /
Machine designation:
Frequency inverter Type:
Serial-No.:

**Supplement S10 to the operating instructions
for frequency inverter VCB 400 with
RS485 – connection VCI-485**

VCB 400-010	—	4 kW
VCB 400-014	—	5.5 kW
VCB 400-018	—	7.5 kW
VCB 400-025	—	11 kW
VCB 400-034	—	15 kW
VCB 400-045	—	22 kW
VCB 400-060	—	30 kW
VCB 400-075	—	37 kW
VCB 400-090	—	45 kW
VCB 400-115	—	55 kW
VCB 400-135	—	65 kW
VCB 400-150	—	75 kW
VCB 400-180	—	90 kW
VCB 400-210	—	110 kW
VCB 400-250	—	132 kW
VCB 400-300	—	160 kW
VCB 400-370	—	200 kW
VCB 400-460	—	250 kW
VCB 400-570	—	315 kW

Valid from frequency inverter– Software – Version V2.1
Item - No. of the supplement 051 110 068
Version: June 1998

A IMPORTANT INFORMATION ON THIS SUPPLEMENT

These operating instructions are valid for the frequency inverter range **VCB 400** with RS485 - connection VCI-RS485.

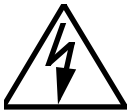
A **list of contents** is provided for you at the beginning of this supplement to the operating instructions.

The **Operating Instructions Part 1 General information and power section** contains general information, the construction and layout drawings, technical data, the dimensional drawings and the description of the cable connections..

The **Operating Instructions Part 2 Control section and parameterisation** describes certain configurations with the relevant control connections and provides information about the handling of the control unit **KP 100**, the individual equipment parameters and their parameterisation.

The **Instructions for the RS485 – connection VCI-485** supplements the documentation for the frequency inverter. The information required to use the communication interface is described in the following chapters.

For more clarity the following pictograms are used in the operating instructions for warnings and notes.:



⇒ Caution! Lethal risk from high direct contact voltage..



⇒ Caution! Instruction must be observed..



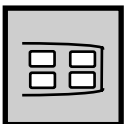
⇒ Caution! Disconnect the unit from the mains before performing any operation and wait at least 5 minutes until the intermediate circuits capacitors have discharged to a safe residual voltage.



⇒ Prohibited! Incorrect handling may damage the equipment..



⇒ Useful information, tip.



⇒ Setting can be changed using the control unit KP 100.



⇒ This parameter can be adjusted in each of the four data records.

CONTENTS

A	Important information on this supplement	A-2
A.1	Further information	A-4
1	General information.....	1-1
1.1	Safety instructions	1-1
2	RS485 - connection VCI-485	2-1
2.1	Specification for the RS485 – interface.....	2-2
2.2	Specification for the control inputs.....	2-3
3	Transmission medium	3-1
3.1	Hardware	3-1
3.2	Subscriber addresses	3-2
4	Data transmission.....	4-1
4.1	Character format.....	4-1
4.2	Control characters and symbols	4-1
4.3	Data formats.....	4-2
4.4	Data access.....	4-2
4.5	Setting the baud rate.....	4-2
4.6	Protocol	4-3
4.6.1	Enquiry-telegram	4-3
4.6.2	Select-telegram	4-4
5	Telegram check.....	5-1
5.1	Checksum determination "BCC"	5-1
5.2	Reaction to telegram errors	5-1
5.2.1	Enquiry-telegram	5-1
5.2.2	Select-telegram	5-1
5.3	Error message and acknowledgement	5-2
6	Timing	6-1
6.1	Enquiry-telegram	6-1
6.2	Select-telegram.....	6-1
6.3	Time-out	6-1
6.4	Communication watchdog	6-1
7	Block transmission of multiple parameters.....	7-1
8	Setpoint/Control in the bus mode.....	8-1
8.1	Setpoint defaults in the bus mode.....	8-1
8.2	Control in the bus mode	8-2
9	Parameter list RS485 - connection VCI-485	9-1
9.1	Display parameters	9-1
9.2	Parameters for the RS485 - connection	9-1

A.1 FURTHER INFORMATION

These operating instructions have been drafted with the greatest care and have been extensively checked several times. For reasons of clarity, not all detailed information on all product models and also not every conceivable case of installation, operation or maintenance could be taken into account. Should you require further information or if particular problems should occur which are not treated in enough detail in the operating instructions you may request the necessary information from the local agent of VECTRON Elektronik.

We also like to remind you that the contents of these operating instructions are not part of any previous or current agreement, confirmation or legal relationship nor should they amend this. All the manufacturer's obligations ensue from the relevant sales contract which also includes the complete and solely valid terms of warranty.

These contractual terms of warranty are neither extended nor restricted by the implementation of these operating instructions.

The manufacturer retains the right to correct or alter the contents and product details as well as omissions without previous notice and accepts no liability for damage, injuries or expenses due to the aforementioned reasons.

1 GENERAL INFORMATION



1.1 SAFETY INSTRUCTIONS

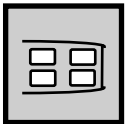
The appropriate instructions for a safe handling and operation of the frequency inverter can be found in our **Operating instructions Part 1 and Part 2**.

2 RS485 - CONNECTION VCI-485



The control hardware and software for the frequency inverter models VCB is virtually freely configurable. This means that theoretically certain functions can be assigned to the control connections and one has virtually a free choice of the software modules used and their internal connection.

This modular concept allows you to adapt the frequency inverter to a number of different drive tasks.



The demands on the control hardware and software are common for known drive tasks. Thus, certain functional assignments for the control connections and the internal connection of the software modules can be determined. These fixed assignments can be selected with the parameter *Configuration 30 (CONF)*.

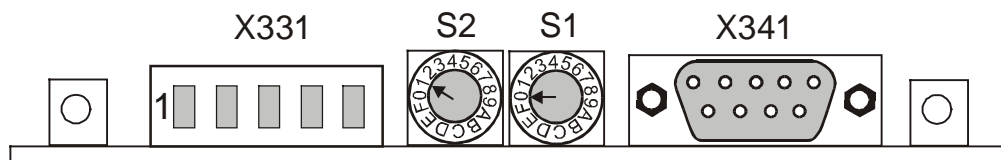
The frequency inverter can be parameterised via the KP 100 control unit or the serial RS485 interface. The number of bus nodes which can be addressed via a bus master is limited to a maximum of 30 subscribers by the standardised interface design.

All control connections and the communication interfaces for the frequency inverter are located under the cover, which may have to be removed. (Operating instructions Part 1, Construction and layout drawing).

The extension card RS485 - connection VCI-PROF is connected to the 2-wire bus via the 9-pin Sub-D socket marked X341.

The identifier (1 ... 31), which is clearly assigned to a frequency inverter within the network, should be set with a length of 8 bits via the hex code switches S1 and S2. The digital inputs on the strip terminal X331 can be freely configured in future.

Front view of extension card RS485 – connection VCI-485



Note: The extension card **RS485 - connection VCI-RS485** is **not** standard equipment for the frequency inverter and must be listed separately in your order

2.1 SPECIFICATION FOR THE RS485 – INTERFACE

The RS485 interface is designed as a DB9-socket according to standards. The physical transmission complies with the standard ITU V.11 and the ANSI Standard EIA/TIA-422B. Pins 1+2 and 7+8 are each connected to the connection assembly (bridged). This enables an easy fabrication of the wiring.

The necessary terminating impedance (R_TERM) of 150 ohm in the last bus subscriber of a network line must be connected by a bridge from terminal X341-4 to X341-8.

Pins GND and + 5V should only be taken into account in the wiring when using the optional interface converter ADA-VC-1 RS232 <> RS485. The distribution voltage for the interface is not suitable to supply external assemblies.

RS485 - INTERFACE X341	
X341-1	B, short-circuit-proof and insulated, max. current 60mA
X341-2	B', short-circuit-proof and insulated, max. current 60mA
X341-3	GND
X341-4	Bus termination R_TERM with 150 ohms through bridge to X341-8
X341-5	Distribution voltage interface converter + 5V
X341-6	GND
X341-7	A, short-circuit-proof and insulated, max. current 60mA
X341-8	A', short-circuit-proof and insulated, max. current 60mA
X341-9	Distribution voltage interface converter + 5V

The node-Id must be set with the Hex code switch. There must be a clear assignment of the node-Id setting within the network using the code switch.

HEX-CODIERSCHALTER	
S1	High Nibble of the 8-bit hexadecimal identifier
S2	Low Nibble of the 8-bit hexadecimal identifier

2.2 SPECIFICATION FOR THE CONTROL INPUTS

DIGITAL INPUTS X331	
X331-1	Floating digital input (S9IND), control input controller release, PLC-compatible, max. 30 V, input current 10 mA at 24 V
X331-2	Floating digital input 1 (S10IND), PLC-compatible, max. 30 V, input current 10 mA at 24 V
X331-3	Floating digital input 2 (S11IND), PLC-compatible, max. 30 V, input current 10 mA at 24 V
X331-4	Floating digital input 3 (S12IND), PLC-compatible, max. 30 V, input current 10 mA at 24 V
X331-5	GND floating digital inputs (GND 1)

The control inputs and outputs of the frequency inverter are wired on printed terminals from the firm of Phoenix Contact. The connection consists of the mounted base housing and the plug marked with the terminal names.

Technical Data		
Rated voltage / current/ cross-section	V / A / mm ²	125 / 8 / 1.5
Tightening torque	Nm	0.22-0.25
Screw thread	metric	M2
Connection capacity		
rigid / flexible	mm ²	0,14-1,5 / 0,14-1,5
flexible with end splice	mm ²	0,25-1,5
Multiwire connection (2 leads with same cross-sections)		
rigid / flexible	mm ²	0,14-0,5 / 0,14-0,75
flexible with end splice	mm ²	0,25-0,34



Note: MINI-COMBICON patch plugs may only be connected and separated when the power is off. Further details can be found in the manufacturer's product information.
(Phoenix Contact printed terminals MC1,5 G-3,81)

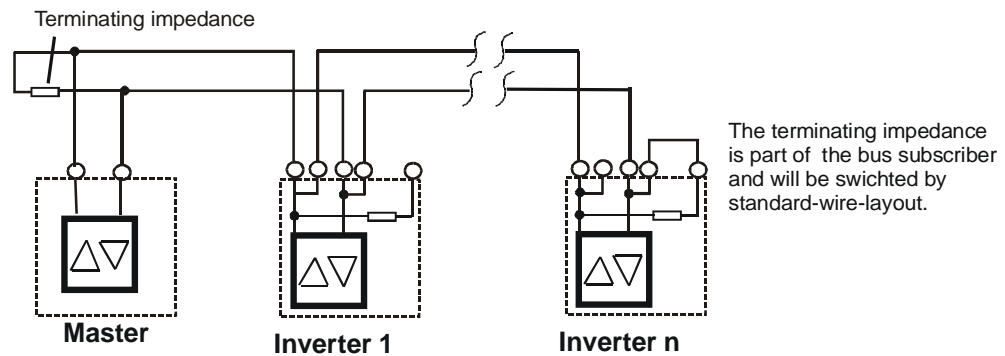
3 TRANSMISSION MEDIUM

3.1 HARDWARE

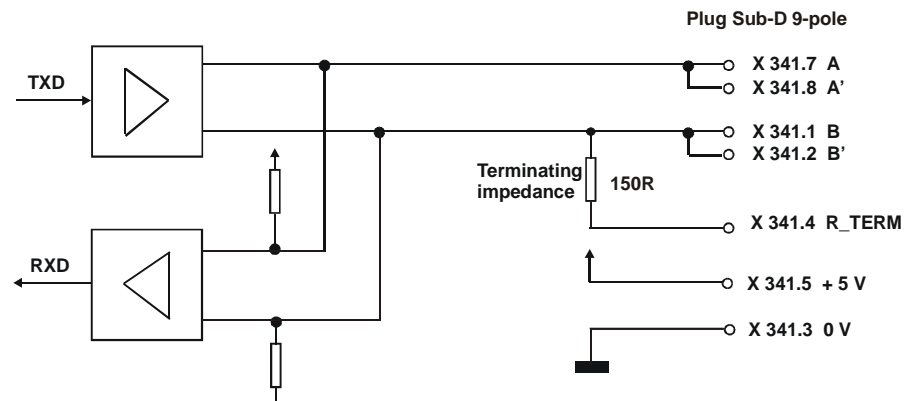
The RS485 connection, switched as a 2-wire connection, is used as a transmission medium. The basic connection of the subscribers is shown in the following wiring diagram.

The connections for the individual subscribers are made using a twisted and shielded lead. The terminating impedance of 150 Ω must be connected at both physical ends of the bus in the bus subscriber. This is carried out by the corresponding connection in the connector plug. Please refer to the following wiring diagrams.

Two-wire bus system



Plug assignment X341 to RS485



3.2 SUBSCRIBER ADDRESSES

Up to 30 inverters can be operated on the bus. These are assigned the addresses 1...30.



Note: The subscriber address is set with the Hex code switch and can be changed during operation of the frequency inverter.

The address "32" is the Broadcast Address which is applicable for all inverters. There is no acknowledgement from the inverter (ACK or NAK) following a transmission with the **Broadcast Address 32** !

If one of the addresses 0, 31 or ≥ 33 is set the inverter is switched offline. It cannot be addressed by the RS485-bus.

Address Codes			
Address	(ASCII-) sign	HEX-value S1	HEX-value S2
1	A	0	1
2	B	0	2
3	C	0	3
4	D	0	4
5	E	0	5
6	F	0	6
7	G	0	7
8	H	0	8
9	I	0	9
10	J	0	A
11	K	0	B
12	L	0	C
13	M	0	D
14	N	0	E
15	O	0	F
16	P	1	0
17	Q	1	1
18	R	1	2
19	S	1	3
20	T	1	4
21	U	1	5
22	V	1	6
23	W	1	7
24	X	1	8
25	Y	1	9
26	Z	1	A
27	[1	B
28	\	1	C
29]	1	D
30	^	1	E
32**	'	1	F

** = Broadcast-Address



Note: The set subscriber address can be read out via the actual value parameter *Bus-Address* **248 (ADR)**. The KP 100 control unit can be used for this purpose if there are communication problems with the frequency inverter.

4 DATA TRANSMISSION

4.1 CHARACTER FORMAT

A character consists of:

- 1 Start bit
- 8 Information bits (7 Data bits, 1 Parity bit)
- 1 Stop bit

The 8 information bits code text and control characters. The characters are taken from the 7-bit code according to DIN 66003 and are supplemented to an **even** parity.

The start bit is followed by the lowest order bit.

Start	b1	b2	b3	b4	b5	b6	b7	Parity	Stop
-------	----	----	----	----	----	----	----	--------	------

Parity = even

4.2 CONTROL CHARACKTERS AND SYMBOLS

The following control characters are used to check the data flow between the bus subscribers:

Settings		
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

The following symbols have been derived from the control characters shown above and will be used in these operating instructions:

Control characters and symbols	
EOT	Control character End_Of_Transmission
ADR	Address of selected inverter, (see "Subscriber addresses")
STX	Control character Start_Of_Text
0	this zero is necessary for internal, formal reasons (*)
p	Data record number (0, 1, 2, 3 or 4 (*))
nnn	Parameter number (001...999 (*))
aa	Number of following data bytes (01...99 (*))
www...www	Data bytes ASCII-HEX-numbers (0...F)
ETX	Control character End_Of_Text
ENQ	Control character Enquiry
BCC	BCC Binary-Checksum, (see "Checksum determination BCC")
ACK	Control character Acknowledge (positive acknowledgement)
NAK	Control character Negative_Acknowledge (negative acknowledgement)

(*) = ASCII-decimal numbers

4.3 DATA FORMATS

The types word, double word and string are permissible data formats. The type prescribed for the selected parameter is listed in the parameter table.

A word is transmitted as a 16-bit integer in four Hex-ASCII-characters. A double-word (32-bit integer) accordingly in eight Hex-ASCII-characters.

Strings can have variable lengths. The maximum length of a string is listed in the parameter table.

4.4 DATA ACCESS

Access to the parameter values is via the parameter number and the desired data record. Parameters exist whose values are only present once (data record 0) and there are also parameters whose values exist four times (data record 1...4). These are used for the data record changeover.

If parameters which are present four times in the parameter records are described with the default data record = 0 all four parameter records are set to the same transmitted value. These parameter records can only be read with data record = 0 if all four parameter sets have the same value. If this is not the case the system reports Error 9 = "Parameter record values differ" (cf. Chapter on error acknowledgement).

Parameters can also be written without their values being transferred to the EEPROM. This is particularly interesting for setpoint defaults. In this case the setting for the addressed data record is increased by "5".

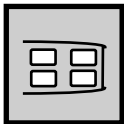
Data record = 5 means data record = 0, only RAM

the following then also applies:

Data record = 6 means data record = 1, only RAM etc.

The parameters must be transmitted in the prescribed formats (word, double word) otherwise the system reports the error message 10 = "Incorrect parameter type".

4.5 SETTING THE BAUD RATE



The data transfer rate of the serial RS485 interface can be set with the parameter **Baud rate 10 (BAUD)** on control level 2.

Setting	
Parameter 10 (BAUD)	Baud-rate
1	2400 Bit/s
2	4800 Bit/s
3 (works setting)	9600 Bit/s
4	19200 Bit/s



Note: The baud rate must be set equivalently for the transmitter and receiver. The frequency inverter is configured with the parameter **Baud rate 10 (BAUD)**. If the inverter cannot be addressed via the RS485 interface you should check the setting.

4.6 PROTOCOL

The system works as a purely Master/Slave bus. The Bus-Master is a PC, a PLC or any computer system.

The communication protocol complies with the ISO standard 1745 for standard mode transmissions. Only text character strings without a header are used. Error control is by means of the parity-bound transmission of the individual 7-bit characters according to DIN 66003. Parity checks are in accordance with DIN 66219 (even parity).

Two types of telegrams are used:

1. **Enquiry-Telegram**, inquires parameters in the inverter through the Bus-Master.
2. **Select telegram**, to transfer parameters through the Bus-Master to the inverter.

4.6.1 ENQUIRY-TELEGRAM

The Enquiry-Telegram from the Bus-Master requests the inverter to send the data contents of the inquired parameter number. The inverter sends the requested data to the Bus-Master in the Enquiry-Response-Telegram. This is concluded by transmitting EOT.

Bus-Master:

EOT	ADR	0	p	n	n	n	ENQ
-----	-----	---	---	---	---	---	-----

Inverter:

ADR	STX	0	p	n	n	n	a	a	w	w	w	w	ETX	BCC
-----	-----	---	---	---	---	---	---	---	---	---	------	---	---	-----	-----

or in the vent of an error

ADR	NAK
-----	-----

Bus-Master:

EOT

If the inverter does not respond or returns incorrect data the Enquiry-Telegram is repeated three times (a total of three transmissions are possible).

NAK indicates an error. An error can have various causes. These can arise due to a disturbed transmission, incorrect data or an incorrect string structure.

The error register SSError **must** be read out after a NAK.



Note: Numerical values are shown as 16-bit integers. Thus, 4 ASCII-HEX characters always exist for **one** number to be transmitted.

Example of an Enquiry-Telegram:

Enquiry-Telegram from Master to inverter number 1 (bus address 1 = A) for the parameter *Stator frequency* **210 (FS)** in data record 0; data format = double word.

Hex :
04 41 30 30 32 31 30 05

ASCII:
EOT A 0 0 2 1 0 ENQ

The response to the Enquiry-Telegram sent to subscriber address 1 for a stator frequency of 50.00 Hz (5000 = 1388h) is as follows:

Hex :
41 02 30 30 32 31 30 30 38 30 30 30 30 31 33 38 38 03 3a

ASCII:
A STX 0 0 2 1 0 0 8 0 0 0 0 1 3 8 8 ETX :



Note: There is no acknowledgement with ACK or NAK to a Broadcast transmission (subscriber address 32)

4.6.2 SELECT-TELEGRAM

The Select-Telegram transfers data to the inverter.

Bus-Master:

EOT	ADR	STX	0	p	n	n	n	a	a	w	w	...	w	w	ETX	BCC
-----	-----	-----	---	---	---	---	---	---	---	---	---	-----	---	---	-----	-----

Inverter:

ADR	ACK	ADR	NAK
-----	-----	-----	-----

Bus-Master:

EOT

ACK from the inverter confirms a correctly received string.
NAK indicates an error. An error can have various causes. These can arise due to a disturbed transmission, incorrect data or an incorrect string structure.
The error register SSError **must** be read out after a NAK.



Note: Numerical values are shown as 16-bit integers. Thus, 4 ASCII-HEX characters always exist for **one** number to be transmitted.

Example of a Select-Telegram:

Select-Telegram from the Master to subscriber address 1 (bus address 1 = A) to change the parameter *Start voltage* **600 (US)** in data record 1, data type = word. A voltage of 5.0 V should be set (50 = 32h):

Hex :
04 41 02 30 30 36 30 30 30 34 30 30 33 32 03 30
05

ASCII:
EOT A STX 0 0 6 0 0 0 4 0 0 3 2 ETX 0



Note: There is no acknowledgement with ACK or NAK to a Broadcast transmission (subscriber address 32)

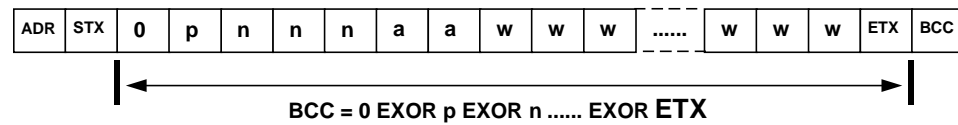
5 TELEGRAM CHECK

The inverter and Bus-Master check that the telegrams are correct. There is a corresponding reaction depending on the type of telegram. The telegrams are checked for syntax, address and text part (content, checksum).

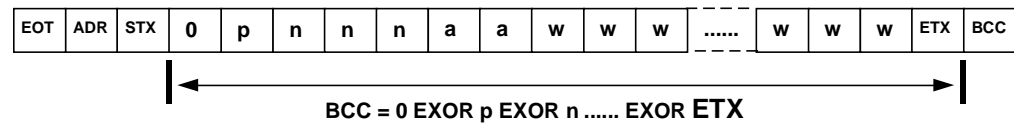
5.1 CHECKSUM DETERMINATION "BCC"

The checksum BCC consists of one byte containing the EXOR-operation of all bytes between STX (exclusive) and ETX (inclusive).

Transmission request:



Request for placing:



5.2 REACTION TO TELEGRAM ERRORS

5.2.1 ENQUIRY-TELEGRAM

no response

- incorrect telegram structure
- incorrect control character
- incorrect subscriber address

NAK - cf. Table in the chapter on error acknowledgement

5.2.2 SELECT-TELEGRAM

no response

- incorrect telegram structure
- incorrect control character
- incorrect subscriber address

NAK - cf. table in the chapter on error acknowledgement

ACK - valid telegram

5.3 ERROR MESSAGE AND ACKNOWLEDGEMENT

If a transmission (Enquiry-Telegram or Set command) receiver responds with NAK, the error register SSError must be read out of the interface before a new **Select-Telegram**. The receiver will not accept any new Select-Telegram until the error register has been read out.



Note: Enquiry-Telegrams are accepted and answered irrespective of the error status. This allows troubleshooting via the status word of the frequency inverter.

When the parameter *Error register 11 (SSTER)* is read it is deleted and thus released at the same time. The messages in the error register SSError should be interpreted in accordance with the following table.

Error messages	
SSError	Type of error
0	No error
1	Invalid parameter value
2	Invalid data record
3	Parameter cannot be read (write-only)
4	Parameter cannot be written (read-only)
5	Read error EEPROM
6	Write error EEPROM
7	Checksum error EEPROM
8	Parameter cannot be written during current operation
9	Values in parameter sets differ
10	Incorrect type of parameter
11	Unknown parameter
12	Checksum error in received string
13	Syntax error in received string
14	Data tape of parameter does not match number of bytes in string
15	Unknown error

6 TIMING

The bus works in the Master-/Slave mode. If an inverter is addressed by the Bus-Master a further inverter will only be addressed when the bus protocol has completely finished with the first converter or a time-out occurs.

Once an inverter has sent, the inverter needs a wait time of 2 ms to deactivate the RS485-transmitter. Only then can the Bus-Master send a new telegram .

The inverter replies at the earliest 10 ms after receiving a telegram. This means that the Bus-Master must have deactivated its RS485-transmitter after 10 ms at the latest .

6.1 ENQUIRY-TELEGRAM

An inverter can be addressed again immediately after it has replied to an Enquiry-Telegram.

6.2 SELECT-TELEGRAM

An inverter can be addressed again immediately after it has replied to a Select-Telegram.

6.3 TIME-OUT

If the Bus-Master receives no reply from the inverter after 500ms it can start a new transmission to any inverter.



Note: With a high CPU load - (> 90%) the response time can be greater than 500 ms.
If the inverter has not received any characters within 500 ms it rejects any character strings it has already received and awaits a completely new transmission.

6.4 COMMUNICATION WATCHDOG

If the inverter is operated through the serial interface (RS232, RS485) it may be important to monitor the presence of communication path. The inverter may be switched on and off in the remote mode or may only receive its setpoint cyclically through the serial interface. If the communication breaks down, no or only faulty data will be transmitted. This status is detected by the communication watchdog.

Function

The watchdog function monitors the time within which no correct communication takes place. This time can be set with the parameter *RS232/RS485 Watchdog Timer 413 (WDOG)*. The set value is the time in seconds (range 0....10,000 seconds). If the time set = 0 the watchdog function is deactivated (work's setting).

Once the set monitoring time is reached the inverter reports a fault. The error message is **F2010 Watchdog RS232/485** (20 = communication error, 10 = Watchdog RS232/RS485).

Settings						
Parameter			Setting range		Work's setting	Control level
No.	Abbr.	Meaning	Min	Max		
413	WDOG	RS232/RS485 Watchdog	0 s	10000 s	0	3

The watchdog is reset under respectively defined conditions for the Enquiry and Select telegrams.

- **Enquiry-Telegram**

The watchdog function is reset if the Enquiry-String has been received correctly and its contents have received a positive response. This means that the parameter exists and parameter/data record assignment must be correct.

- **Select-Telegram**

Since it must be ensured that the actuating variables (control word, setpoint) are also correct with respect to the data values and data record assignments the watchdog can only be reset if no error has occurred during processing of the string. This means that the response to the Select-Telegram from the inverter must be an "ACK" so that the watchdog can be reset. If, for example, setpoints are continuously transmitted which are not within the defined value range, the watchdog function will deactivate the inverter.



Note: Before acknowledging the fault (per contact or control word) a correct data communication must have taken place (e.g. read status word or current error).

7 BLOCK TRANSMISSION OF MULTIPLE PARAMETERS

If a number of parameters are to be transmitted regularly 'en 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 block definition has to be written in the parameter *Block definition 017* before a block transmission can be carried. (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.

- **Parameter *Block definition 017***

The block definition is a string containing the parameter numbers of the parameters in the block as five-digit decimal figures in succession, whereby the first figure is the data record number and the second to fourth figure the actual parameter number.

A block can have a maximum string length of 80 characters.

0pnnn0pnnn ... 0pnnn

- **Parameter *Write block 018***

Parameter *Read block 019*

The data block is a string containing the values of the parameters in a 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 transmission:

Read parameter *Stator frequency 210 (FS)*, *Effective current 211 (I RMS)* and *True power 213 (PW)*, each from data record 0.

```
write parameter 017:      "002100021100213"
read parameter 019:      "00002A5D00660028"
```

```
->          FS (Double word = 8 Hex digits): 00002A5D(hex) = 10845(dec)
              I RMS (Word = 4 Hex digits): 0066(hex) = 102(dec)
              PW (Word = 4 Hex digits): 0028(hex) = 40(dec)
results in:   FS = 108.45 Hz, I RMS = 10.2 A, PW = 4.0 kW.
```

Write the motor parameters *Nominal voltage 370 (MUR)* and *Nominal current 371 (MIR)* to data record 1.

```
Values:      MUR (Word = 4 Hex digits) = 400,0 V, 4000(dec) = 0FA0(hex)
              MIR (Word = 4 Hex digits) = 180,0 A, 1800(dec) = 0708(hex)
```

```
write parameter 017:      "0137001371"
write parameter 018:      "0FA00708"
```



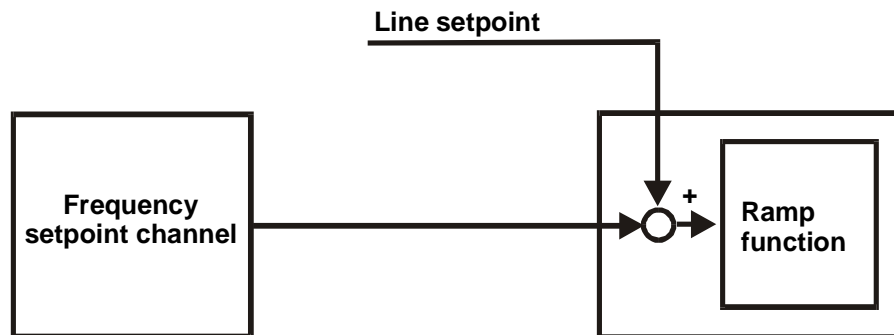
Note: The parameters used in the example above are described in Part 2 of the Operating Instructions. The data format of the respective parameter can be derived from the setting and display range.

8 SETPOINT/CONTROL IN THE BUS MODE

8.1 SETPOINT DEFAULTS IN THE BUS MODE

The setpoint defaults essentially depend on the pre-set configuration. The configurations described in Part 2 of the Operating Instructions contain the frequency and percentage setpoint channel for the setpoint defaults.

The linear setpoint for the frequency is entered in the parameter *Frequency linear setpoint* **484 (FFR)** and for the percentage value in the parameter *Percentage linear setpoint* **524 (FPR)**. This setpoint is added to the internal setpoint from the setpoint channel at the start of the ramp function. In the configuration 111 with technology controller the actual value can also be defined via the parameter *Percentage actual value RAM* **529 (FPRI)**, depending on the mode of the parameter *Percentage actual value source* **478 (APSEL)**,.



This enables a combination of linear setpoint and internal setpoint default.

Example:

In configuration 110 the internal frequency setpoint channel is to be used with fixed frequencies. The speed setpoint is also transmitted to the address of the frequency linear setpoint via the RS485 interface.

Part2 of the Operating Instructions describes the setting for the parameter *Frequency setpoint source* **475 (RPSEL)**. In the operating mode 10 the internal setpoint default is defined by the pre-set fixed frequencies. The four fixed frequencies of a data record, which are to be added to the linear setpoint, can be freely parameterised. The contact inputs allow a changeover between the pre-set fixed frequencies. The linear setpoint transmitted via the bus system is set in steps of in $\frac{1}{100}$ Hz and added to the current internal setpoint. The data format for the parameter *Frequency setpoint* **484 (FFR)** is signed long and should be set in the range between –999.99 Hz and 999.99 Hz. The sum total of the transmitted linear setpoint and the internal setpoint is limited by the pre-set range of the limit frequencies. The pre-set linear setpoint, parameter *Setpoint frequency Bus* **282 (F-BUS)**, and the value after addition, parameter *Setpoint frequency ramp* **283 (FRAMP)**, can be read out as actual values in the VAL menu.

Settings				
Parameter			Example setting	Unit.
No.	Abbr.	Meaning		
475	RPSEL	Frequency SP source	10	-
484	FFR	Frequency SP RAM	-	$\frac{1}{100}$ Hz



Note: The addition of the internal setpoint to the linear setpoint can lead to a change in the direction of rotation depending on the selected sign. The result of the addition is independent of the pre-set direction of rotation, which is set via the digital contact inputs.

8.2 CONTROL IN THE BUS MODE

The frequency inverter is controlled via the parameter *Control word 410 (CMD)*. Status messages are shown via the parameter *Status word 411 (STAT)*.

Control and status words are structured according to DRIVECOM.

Reference is made to the DRIVECOM specifications for the meaning of the individual statuses. The inverter is only controlled via the bus in case the inverter has been switched to the remote mode. The mode selected with the parameter *LocalRemote-Flag 412 (REMOT)* deactivates the sole release via contact input S1IND.

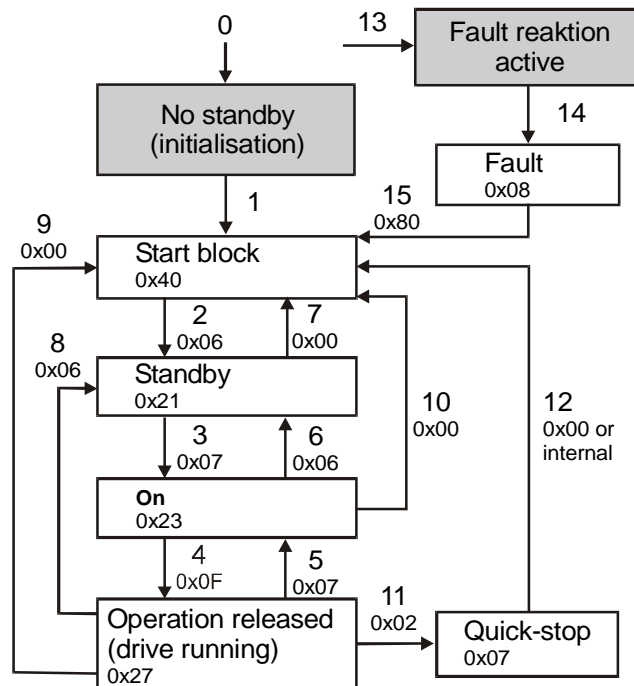
The remote mode is activated by setting the parameter *LocalRemote-Flag 412 (REMOT)* and the parameter control word and/or status word become visible. This enables a test operation via the optional KP 100 control unit or control software.



Note: If the remote mode is activated, release can only be via the communication channel, and this only if the hardware release (S1IND) and Start right (S2IND) have been switched on !

The inverter is started and stopped in the remote mode via the control word and the internal status is read via the status word. The sequence is defined in the status machine.

Status machine:



Note: We are preparing an extension of the status machine with the function "quick-stop".

The parameter *Control word 410 (CMD)* is a read and write parameter. The desired control command is transmitted according to the DRIVECOM specification. The control word is defined as follows in the bit sequence:

Control word		
Bit-Nr.	Name	
0	Start	
1	Voltage block	
2	Quick stop	(in preparation)
3	Release operation	
4	-	
5	-	
6	-	
7	Reset fault	
8	-	
9	-	
10	-	
11	-	
12	-	
13	-	
14	-	
15	-	

A device control command is executed in accordance with the bit combination in the control word. The executed command corresponds to a transition in the shown status machine.

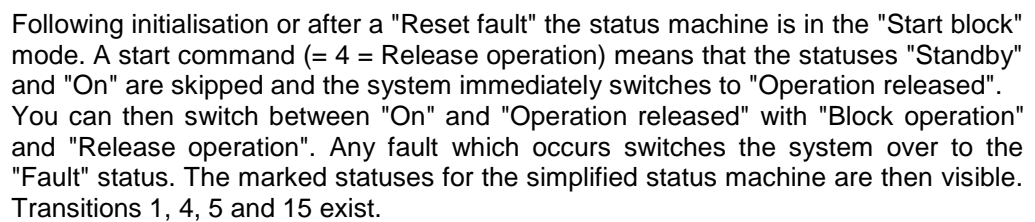
Command	Control word						Transition
	HEX	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Stop	0x06	x	x	1	1	0	2, 6, 8
Start	0x07	x	x	1	1	1	3
Block voltage	0x00	x	x	x	0	x	7, 9, 10
Quick stop	0x02	x	x	0	1	x	7, 10, 11
Block operation	0x07	x	0	1	1	1	5 oder FUF = 0
Release operation	0x0F	x	1	1	1	1	4 und FUF = 1
Reset fault	0x80	0 ⇒ 1	x	x	x	x	15

To make operation of the device even easier, a further transition has been implemented in addition to the status machine defined under DRIVECOM. An additional transition from "Start block" to "Release operation" has been provided.

The shaded commands are those which are relevant for the simplified status machine. The other commands are not used there.



Note: An error message must be acknowledged by the user. This may be sent up to 15 seconds after the occurrence of the fault since the inverter has an internal delay. The command "Reset fault" is only activated after the delay for the named reason and is set on the positive flank of bit 7.



Status word	
Bit-No.	Name
0	Standby
1	On
2	Operation released
3	Fault
4	Voltage blocked
5	Quick-stop
6	Start block
7	Alarm
8	-
9	Remote
10	Setpoint reached
11	Limit value active
12	-
13	-
14	-
15	UdRegDown

The status word reflects the operating status of the frequency inverter. This is independent of the operating mode selected with the parameter *LocalRemote-Flag 412 (REMOT)*.

Operating status	Status word						
	HEX (*)	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0
Not on standby	0x00	0	x	0	0	0	0
Start block	0x40	1	x	0	0	0	0
Standby	0x21	0	1	0	0	0	1
Quick-stop	0x07	0	0	0	1	1	1
On	0x23	0	1	0	0	1	1
Operation released	0x27	0	1	0	1	1	1
Fault	0x08	0	x	1	0	0	0
Fault reaction active	0x0F	0	x	1	1	1	1

(*) ignoring bits 7 ... 15

The shaded statuses are those which are relevant for the simplified status machine.

The further bits in the status word are directly related to the hardware and software functions of the frequency inverter.

- The alarm bit "7" can be set at any time by the bus subscribers. It indicates an internal alarm from the frequency inverter. An evaluation of which alarm has been sent can be carried out by reading out the alarm status with the parameter *Alarms 270 (WARN)*.
- The remote bit "9" is set if the remote mode is set with the parameter *LocalRemote-Flag 412 (REMOT)* and a hardware release has been received via the digital inputs (S1IND (FUF) = 1 and S2IND (Start right) = 1). The frequency inverter can be only controlled with the status machine shown if the remote bit has been set. The sign for the rotary field is derived from the sum total of the setpoint and line setpoint.
- The setpoint reached bit "10" is set when the default setpoint is reached. In the special case of a mains failure support, the bit is also set when the mains failure support reaches the frequency 0 Hz. A hysteresis (tolerance range) which can be set with the parameter *max. control deviation 549 (DEVMX)* applies for "Setpoint reached" (see operating instructions Part 2).
- The limit value active bit "11" indicates that an internal limit is active. This can be, for example, the current limitation, the moment limitation or the overvoltage control. All functions lead to a divergence from the setpoint or to the setpoint not being reached.
- The UdRegDown bit "15" is an application-specific implementation. This bit is set if the frequency of the Ud-controller falls below the parameter *Threshold shutdown 675 (UDOFF)* in the mains failure mode and the drive has then been forced to run down to zero.
(see operating instructions Part 2).

9 PARAMETER LIST RS485 - CONNECTION VCI-485

9.1 DISPLAY PARAMETERS


VAL menu (Actual values)

No.	Abbr.	Control level	Name/Meaning	Unit	Display range	Chap.
248	ADR	2	Bus address	-	0 ... FF	3.2
282	F-BUS	3	SP frequency bus	Hz	0 ... f_{\max}	8.1
283	FRAMP	3	SP frequency ramp	Hz	0 ... f_{\max}	8.1

9.2 PARAMETERS FOR THE RS485 - CONNECTION

The following parameters are visible irrespective of the installed communication card since they are also relevant for the standard connection X215. The protocol type setting may not be changed in the standard applications.

Communication interface

No.	Abbr.	Control level	Name/Meaning	Unit	Setting range	Chap.	Work's setting
395	PROT	3	Protocol type	-	0: VCB - Bus 1: P - Bus	-	0
412	REMOT	 3	LocalRemote-Flag	-	0: control via contacts 1: control via interface	8.2	0
413	WDOG	3	RS232/RS485 Watchdog Timer	s	0 ... 10000	6.4	0



.....This parameter can be changed over with data records

The specific parameters for the communication interface are only partly shown on the optional KP 100 control unit and control software. Full use of the parameters is only possible via the bus. The parameters *Control word 410 (CMD)* and *Status word 411 (STAT)* are only shown for troubleshooting depending on the parameter *LocalRemote-Flag 412 (REMOT)*.

Parameter extension

No.	Abbr.	Control level	Name/Meaning	Unit	Setting range	Chap.
410	CMD	3	Control word	-	-	8.2
411	STAT	3	Status word	-	-	8.2
484	FFR	-	Frequency SP RAM	Hz	0 ... 999,99	8.1
524	FPR	-	Percentage SP RAM ^{*)}	%	-300,00 ... +300,00	8.1
529	FPRI	-	Percentage actual value RAM ^{*)}	%	-300,00 ... +300,00	8.1

^{*)} only in the configuration 111