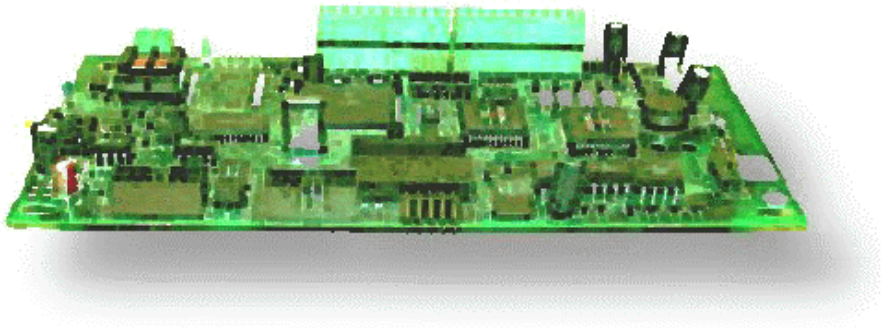
VACON

CX/CXL/CXS

FREQUENCY CONVERTERS



Modbus Fieldbus Option Board

USER'S MANUAL

Subject to changes without notice

FOR SMOOTH CONTROL

vacon

INDEX

1. GENERAL

Vacon frequency converters can be connected to the Modbus by using the fieldbus board. The converter can then be controlled, monitored and programmed from the Host system.

The used I/O can be also extended with the Fieldbus board:
- 4 digital inputs (standard signals)
- 4 digital outputs (standard signals)
- Thermistor input (can be directly connected to the motor thermistors for overtemperature trip)
- Encoder input

The Fieldbus board can be installed into the already existing place of the option board inside the frequency converter.

The control connections are isolated from the mains potential and I/O ground is connected to the frame of the device via a 1 MΩ resistor and 4.7 nF capacitor*. The control I/O ground can be connected also directly to the frame by changing the position of the jumper X9 (GND ON/OFF) to ON-position. Digital inputs and digital outputs are also isolated from the I/O ground.

NOTE !

Internal components and circuit boards (except for the isolated I/O terminals) are at mains potential when the frequency converter is connected to the mains. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.

The control I/O terminals are isolated from the mains potential, but the I/Os (if jumper X9 is in OFF position) may have dangerous voltage connected even if the power is off on the frequency converter.

* Default value (X9 is GND OFF- position)

2. SPECIFICATIONS

Modbus - connections	Interface	9-pin DSUB connector (female)
	Transfer method	RS-485, Half duplex
	Transfer cable	Twisted pair (1 pair and shield)
	Electrical isolation	500 V DC
I/O -control connections	Digital input (4 pcs)	24 V: "0" ≤10 V, "1" ≥18 V, R_i = 5 kΩ
	Digital output (4 pcs)	Open collector output, 50 mA/48 V
	Termistor input (1 pcs)	R_{trip} = 4.7 kΩ
	Encoder input (3 pcs)	24 V: "0" ≤10 V, "1" ≥18 V, R_i = 3.3 kΩ 5 V : "0" ≤2 V, "1" ≥3 V, R_i = 330 Ω
	Aux. voltage	24 V (±20%), max 50 mA
Safety		Fulfills EN50178 standard

Table 2-1. Specifications

Communication mode	RTU	
Function codes	1	Read Digital Output
	2	Read Digital Input
	3	Read Holding Register
	4	Read Input Register
	5	Write Single Digital Output
	6	Write Single Register
	8	Diagnostic
	Broadcast (codes 5,6)	
Communication parameters		
- Address	1 to 247	
- Parity	None, Odd or Even	
- Stop Bits	1	
- Baud Rate	300 to 19200 Baud	

Table 2-2. Modbus communication data

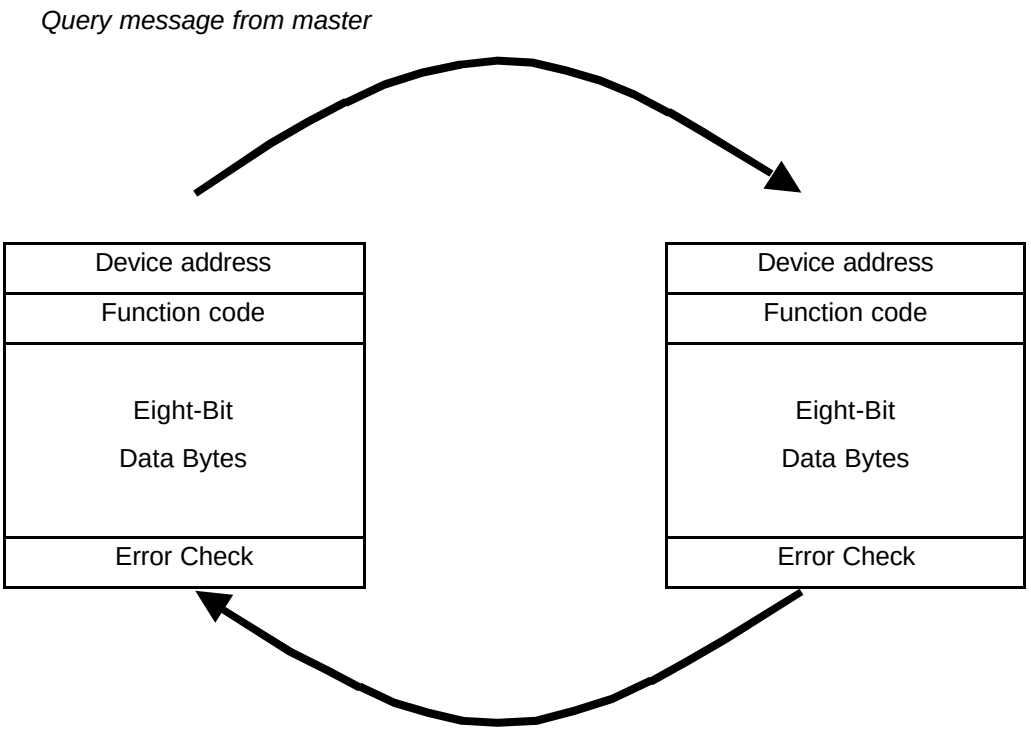
3. MODBUS

3.1 General

The MODBUS protocol is an industrial communications and distributed control system to integrate PLCs, computers, terminals, and other monitoring, sensing, and control devices. MODBUS is a Master-Slave communications protocol. The Master controls all serial activity by selectively polling one or more slave devices. The protocol provides for one master device and up to 247 slave devices on a common line. Each device is assigned an address to distinguish it from all other connected devices.

The MODBUS protocol uses the master-slave technique, in which only one device (the master) can initiate a transaction. The other devices (the slaves) respond by supplying the request data to the master, or by taking the action requested in the query. The master can address individual slaves or initiate a broadcast message to all slaves. Slaves return a message ('response') to queries that are addressed to them individually. Responses are not returned to broadcast queries from the master.

A transaction comprises a single query and single response frame or a single broadcast frame. The transaction frames are defined below.



3.2 Modbus frames

Two modes of transmission are available for use in a MODBUS system. The modes are ASCII (American Standard Code for Information Interchange), and RTU, (Remote Terminal Unit.). **The Fieldbus board uses only RTU mode.**
The format for each byte in RTU mode:

Coding system: 8-bit binary, hexadecimal 0-9, A-F
Two hexadecimal characters contained in each 8-bit field of the message.

Bits per Byte: 1 start bit
8 data bits, least significant bit sent first
1 bit for even/odd parity, no bit for no parity
1 stop bit if parity is used; 2 bits if no parity

Error Check Field: Cyclical Redundancy Check (CRC)

In RTU mode, messages start and end with a silent 3.5 characters times (T1-T2-T3-T4). The entire message frame must be transmitted as a continuous stream. A typical message frame is shown below.

Start	Address	Function	Data	CRC Check	End
T1-T2-T3-T4	8 bits	8 bits	n*8bits	16 bits	T1-T2-T3-T4

The individual slave devices are assigned addresses in the range of 1 - 247. Address 0 is used for the broadcast address, which all slave devices recognize.

3.3 Modbus functions

The Function Code field tells the addressed slave what function to perform. The following table lists those functions supported by the Fieldbus board:

Code	Name	Meaning of Fieldbus board
01	READ COIL STATUS	Read Control bits
02	READ INPUT STATUS	Read Status bits
03	READ HOLDING REGISTER	Read VACON parameter
04	READ INPUT REGISTER	Read VACON variable
05	FORCE SINGLE COIL	Write Control bits
06	PRESET SINGLE REGISTER	Write VACON parameter
08	DIAGNOSTICS	Test and checking of the communication system

3.4 Error detection

Communications errors usually consist of a changed bit or bits within a message. Communications errors are detected by character framing, a parity check, and a redundancy check.

The MODBUS system provides several levels of error checking to assure the quality of the data transmission. To detect multibit errors where the parity has not changed, the system uses redundancy checks: Cyclical Redundancy Check, (CRC), for the RTU mode and Longitudinal Redundancy Check, (LRC), for the ASCII mode. The Fieldbus board uses only RTU mode.

3.5 Exception responses

If the slave receives the query without a communication error, but cannot handle it, the slave will return an exception response informing the master of the nature of the error. The exception response codes are listed below.

Code	Name	Description
01	ILLEGAL FUNCTION	The message function requested is not recognized by the slave.
02	ILLEGAL DATA ADDRESS	The received data address is not an allowable address for the slave.
03	ILLEGAL DATA VALUE	The received data value is not an allowable value for the slave.
04	SLAVE DEVICE ERROR	An unrecoverable error occurred while the slave was attempting to perform the requested action,
06	SLAVE DEVICE BUSY	The message was received without error, but the slave was engaged in processing a long duration program command

In an exception response, the slave sets a most-significant bit (MSB) of the function code to 1. The slave returns an exception code in the data field.

Example:

Query:

01	01	04	2E	00	01	CRC16
Slave address	Function	Starting address HI	Starting address LO	Number of bits HI	Number of bits LO	2 bytes

Exception Response:

01	81	02	CRC16
Slave address	Function	Response code	2 bytes

4. INSTALLATION

NOTE! These instructions apply if you have received the Modbus board as an accessory. Otherwise the board has already been installed for you at the factory.

Before starting the commissioning, carefully read the safety instructions from the "User's manual CX/CXL/CXS frequency converter" chapter 2. Check that you have got all the Fieldbus board parts: Fieldbus board, plastic board, power cable (black terminal), data cable (blue terminal) and earthing screw. Fieldbus board can be installed into the already existing place of the option board inside the frequency converter (see figure 4-1).

A	Remove the control panel and jumper X4 from the control board (**1**).
B	Install the power cable into the control board terminal X5 (**2**) and data cable to terminal X14 (**3**). Power cable can also be installed into terminal X6, if the power cable from the power board is connected to terminal X5.
C	Bend the data cable to an "S-curve" as far as possible from the power board transformer (**4**) before you place the plastic board onto the control board.
D	Remove the protection foil of the plastic board and install the plastic board onto the control board. Check the right position of the plastic board (**5**).
E	Place the Fieldbus board onto the plastic board by the larger holes and push it downwards so that the narrow part of the hole in the board fits the cut on the sleeve. Check that the installation is stable. If you have difficulties placing the plastic board and Fieldbus board, slightly bend regulator A4 (**6**) and capacitor C59 (**7**) of the control board.
F	Install the power cable to the terminal X1 of the Fieldbus board (**8**)and data cable to terminal X4 (**9**).
G	Install the jumper you removed from terminal X4 of the control board, into terminal X9 of the Fieldbus board (**10**) in ON or OFF position.
H	If the packet includes the cable cover (**11**), install that into position shown in figure 4-1.
I	Install the earthing screw (**12**).
J	After this, install the control panel and connect the needed control signals.

K	If the the Modbus line ends at the Fieldbus board, install the jumper to terminal X12 (see figure 5-1) of the Fieldbus board.

L	If you use a 5 V encoder input, install the jumper to terminal X7 see figure 5-1) of the Fieldbus board.

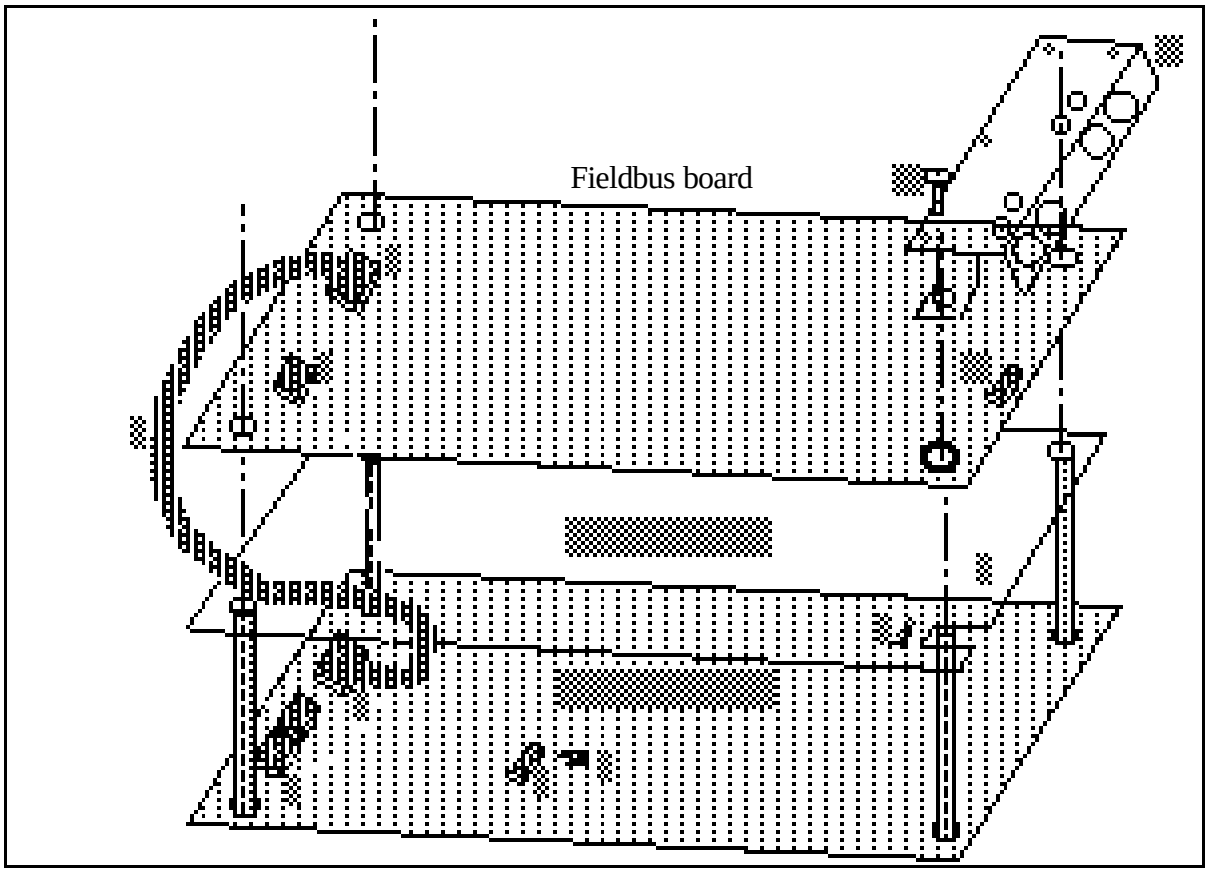
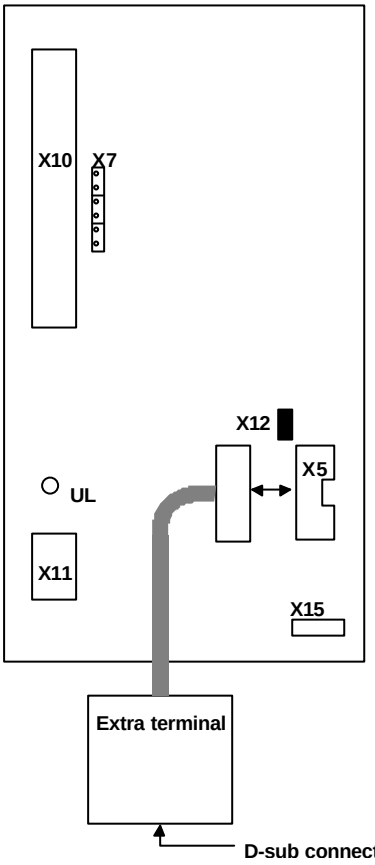


Figure 4-1. Fieldbus board installed on the control board

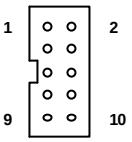
5. CONNECTIONS

5.1 Board layout



Terminals:

X10	I/O - terminals
X11	Termistor input
X7	Encoder terminal
X5	Modbus terminal



X12	Line terminator (120Ω)ON/OFF
X15	Connector for cable Shield

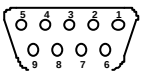
Figure 5-1. Fieldbus board

Diagnostic LED:

UL	Supply Voltage, Green. UL led is active if the Fieldbus board has supply voltage.

5.2 Modbus connections

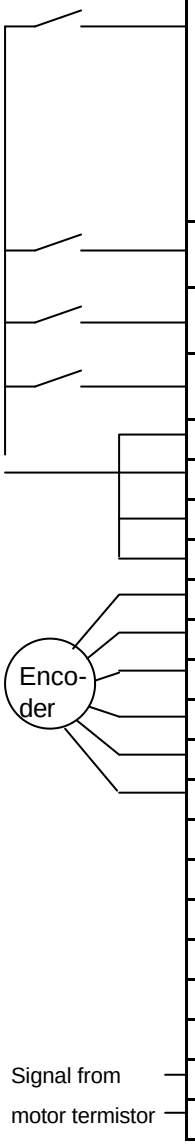
D SUB connector:



Signal	Connector D SUB 9-pin	Board Connector X5 - terminal	Description
Data (A)	2	X5 – 4	Data Out
Data (B)	3	X5 – 5	Data In
GND	7	X5 – 6	Common
Shield		X15	Cable shield

Table 5-1. D-sub connector

5.3 I/O-control connections



Terminal		Signal	Description
301	DID1	Programmable: External fault OR Select of Active Control Source	 Contact open = no fault Contact closed = fault Contact open = VACON IO-terminal Contact closed = Fieldbus
302	DID2	Run disable	Contact open = start of motor enabled Contact closed = start of motor disabled
303	DIE3	Acceler. / Decel. time selection	Contact open = time 1 selected Contact closed = time 2 selected
304	DIE4	Jogging speed selection	Contact open = no action Contact closed = jogging speed
305	COMD	Common for DID1-DID2	Connect to GND or +24 V
306	+24 V	Control voltage output	Voltage for switches, etc. max. 0.1 A
307	COME	Common for DIE3-DIE4	Connect to GND or +24 V
308	GND	I/O ground	Ground for reference and controls
309	DID5A+	Pulse input A	
310	DID5A-	(differential input)	
311	DID6B+	Pulse input B	90 degrees phase shift compared
312	DID6B-	(differential input)	to pulse input A
313	DID7Z+	Pulse input Z	one pulse per one revolution
314	DID7Z-	(differential input)	
315	GND	I/O ground	Ground for reference and controls
316	DOD1	Open collector output 1	READY
317	DOD2	Open collector output 2	RUN
318	DOD3	Open collector output 3	FAULT
319	DOD4	Open collector output 4	FIELDBUS CONTROL
320	GND	I/O ground	Ground for reference and controls
327	TI+	Termistor input	
328	TI-		

Figure 5-2. Control connections

READY = ON, when the mains voltage has been applied and the VACON CX is ready to operate
RUN = ON, when the motor is running
FAULT = ON, if a fault occurs
FIELDBUS CONTROL = ON, when the fieldbus board is the Active Control Source

6. COMMISSIONING

Read first through the commissioning of the frequency converter in Vacon CX/CXL/CXS Frequency Converter, User's Manual (Chapter 8.)

Commissioning of the Fieldbus board:

Check that Multi-purpose Control Application II (or e.g. Fieldbus Application) is selected.
- Parameter P0.1 = 0

Start-up test:

DRIVE APPLICATION

1. Check that the control panel is not the active control source.
   (See User's manual CX/CXL/CXS frequency converter, Chapter 7.)
2. Set parameter "Fieldbus control select" to value 1(On).

MASTER SOFTWARE

Slave address e.g. is 1

1. Write to address 00000 value FF00hex (RUN).
   message: 01 05 00 00 FF 00 8C 3A

2. Read Run State, address 10002.
   message: 01 02 00 02 00 01 49 CA

   If response value is **1** --> Communication is OK.

3. Set to address 40000 value 3E8hex (frequency reference 10,00 Hz).
   message: 01 06 00 01 03 E8 D8 B4

4. The VACON CX shoud now be running and the output frequency shoud be 10,00 Hz.

5. Write to address 00000 value 0000hex (STOP).
   message: 01 05 00 00 00 00 CD CA

7. MODBUS-VACON CX INTERFACE

Features of Modbus-Vacon CX interface:

- Direct control of Vacon CX (e.g. Run, Stop, Direction, Speed reference, Fault reset)
- Full access to all Vacon CX parameters
- Monitor Vacon CX status (e.g. Output frequency, Output current, Fault code ..)
- Diagnostic of modbus communications

7.1 Modbus function codes

7.1.1 Function code 1, Read Control Bits

This function is used to read control bits.
The transaction frames:

Query:

Slave address	Function code	Starting Address HI	Starting Address LO	Number of points HI	Number of points LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Byte count	Data bits	CRC16
1 byte	1 byte	1 byte	1 byte	2 bytes

7.1.2 Function code 2, Read Status Bits

This function is used to read status bits.
The transaction frames:

Query:

Slave address	Function code	Starting Address HI	Starting Address LO	Number of points HI	Number of points LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Byte count	Data bits	CRC16
1 byte	1 byte	1 byte	1 byte	2 bytes

7.1.3 Function code 3, Read Parameters

This function is used to read VACON CX parameters.
The transaction frames:

Query:

Slave address	Function code	Starting Address HI	Starting Address LO	Number of points HI	Number of points LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Byte count	Data HI	Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

7.1.4 Function code 4, Read Variables

This function is used to read VACON CX variables.
The transaction frames:

Query:

Slave address	Function code	Starting Address HI	Starting Address LO	Number of points HI	Number of points LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Byte count	Data HI	Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

7.1.5 Function code 5, Write Control Bits

This function is used to set or clear control bits.
The transaction frames:

Query:

Slave address	Function code	Output Address HI	Output Address LO	Force Data HI	Force Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Output Address HI	Output Address LO	Force Data HI	Force Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

7.1.6 Function code 6, Write Parameter

This function is used to write VACON CX parameters.
The transaction frames:

Query:

Slave address	Function code	Register Address HI	Register Address LO	Data HI	Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Register Address HI	Register Address LO	Data HI	Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

7.1.7 Function code 8, Diagnostic

Diagnostic function uses the subfunction code field in the query to define the type of test to be performed.
The transaction frames:

Query:

Slave address	Function code	Subfunction HI	Subfunction LO	Data HI	Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Response:

Slave address	Function code	Subfunction HI	Subfunction LO	Data HI	Data LO	CRC16
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 bytes

Subfunction codes:

00 Echo
The slave sends back the query message (loop back).

01 Reinitialization
The slave communication part is to be initialized and its events counter is to be cleared. This function is the only one that brings a slave out of Listen Only Mode.

04 Set Listen Only Mode
Forces the slave into Listen Only Mode (LOM). In this mode the slave doesn't process messages. The only function that will be processed after this mode is entered will be the Reinitialization (01).

0A Clear counters
Clears all counters.

0B Bus message count
The quantity of correct messages seen on the line without CRC error or checksum error.

0C Bus communication error count
The quantity of messages received with checksum error.

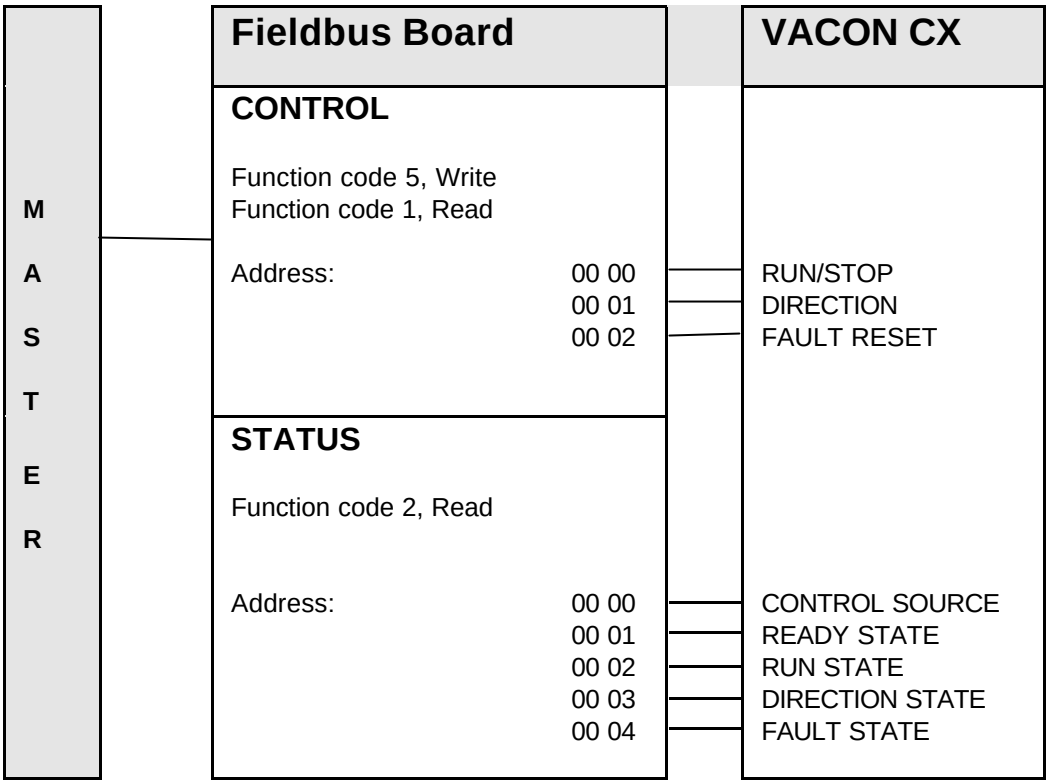
0D Bus exception count
The quantity of Modbus exception responses transmitted to the master by the slave.

0E Slave message count
The quantity of all types of messages addressed to the slave.

0F Slave no response count
The quantity of messages addressed to the slave for which it returned no response.

7.2 VACON control interface

Direct control of Vacon CX uses following function codes and addresses:



Example 1: Read VACON CX run state
Response: Run state (0=stop or 1=run)

Query:

01	02	00	02	00	01	CRC16
Slave addr	Function	Address HI	Address LO	Number of points HI	Number of points LO	2 bytes

Response:

01	02	01	01	CRC16
Slave addr	Function	Byte count	Data	2 bytes

Example 2: Send start command to VACON CX.
Response is an echo of the query.

Query:

01	05	00	00	FF	00	CRC16
Slave addr	Function	Address HI	Address LO	Data HI	Data LO	2 bytes

Response:

01	05	00	00	FF	00	CRC16
Slave addr	Function	Address HI	Address LO	Data HI	Data LO	2 bytes

7.3 VACON parameters

The Vacon variables and parameters can be read and written by using the following function codes and addresses:

Modbus Address	Modbus Register	Function code	Vacon Par/Var	Access rights
40000 - 40099	40001 - 40100	3, 6	References	R/W
40100 - 49999	40101 - 49100	3, 6	Parameters	R/W
30000 - 30099	30001 - 30100	4	Variables	R
30100	30101	4	Fault Code	R

7.3.1 Frequency reference

If the Modbus master is the active control source, the frequency reference can be changed by using the function code 6 or read by using the function code 6. Modbus address according to reference as follows.

Modbus address	Range	Step	Default
40000	Par 1.1 - Par 1.2	0,01 Hz	0,00 - 50,00 Hz

The reference value should be given without decimals (e.g. ref. 10 Hz -> value 1000)

Example 1: Set frequency reference value 10,00 Hz to Vacon CX.
Response is an echo of the query.

Query:

01	06	00	00	03	E8	CRC16
Slave addr	Function	Address HI	Address LO	Data HI	Data LO	2 bytes

Response:

01	06	00	00	03	E8	CRC16
Slave addr	Function	Address HI	Address LO	Data HI	Data LO	2 bytes

7.3.2 Monitoring variables

Monitored item can be read by using the function code 4. Modbus address according to monitored item numbers as follows.

Modbus address	Vacon variable
30000	n1
30001	n2
.	.
.	.
30099	n99

Number	Data name	Step	Unit	Description
n1	Output frequency	0,01	Hz	Frequency to the motor
n2	Motor speed	1	rpm	Calculated motor speed
n3	Motor current	0,1	A	Measured motor current
n4	Motor torque	1	%	Calculated actual torque/nominal torque of the unit
n5	Motor power	1	%	Calculated actual power/nominal power of the unit
n6	Motor voltage	1	V	Calculated motor voltage
n7	DC-link voltage	1	V	Measured DC-link voltage

n8	Temperature	1	°C	Temperature of the heat sink
n9	Operating day counter		DD.dd	Operating days 1), not resettable
n10	Operating hours, "trip counter"		HH.hh	Operating hours 2), can be reset with program-button #3
n11	MW-hours	0,001	MWh	Total MW hours, not resettable
n12	MW-hours, "trip counter"	0,001	MWh	MW-hours, can be reset with programmable button #4
n13	Voltage/analogue input	0,01	V	Voltage of the terminal U_{in}+ (control board)
n14	Current/analogue input	0,01	mA	Current of terminals I_{in}+ and I_{in}- (control board)
n15	Digital input status, gr. A			0 = Open Input, 1 = Closed Input (Active)
n16	Digital input status, gr. B			0 = Open Input, 1 = Closed Input (Active)
n17	Digital and relay output status			0 = Open Input, 1 = Closed Input (Active)
n18	Control program			Version number of the control software
n19	Unit nominal power	0,1	kW	Shows the power size of the unit
n20	Motor temperature rise	1	%	100%= temperature of motor has risen to nominal value

1) DD = full days, dd = decimal part of a day
2) HH = full hours, hh = decimal part of an hour

Table 7-1 Monitored Items

Example 1: Read value of Vacon variable 3.
Response: Value of monitored item (156 = 15,6 A).

Query:

01	04	00	02	00	01	CRC16
Slave addr	Function	Address HI	Address LO	Number of points HI	Number of points LO	2 bytes

Response:

01	04	02	00	9C	CRC16
Slave addr	Function	Byte count	Data HI	Data LO	2 bytes

7.3.3 Active Fault Code

When a fault status is active, fault code can be read by using the function code 3. Modbus address according to the fault code as follows.

Modbus address	**Vacon variable**
30100	Active fault code

List and description of the fault codes are in *USER'S MANUAL VACON CX/CXL/CXS*

Example 1: Read active fault code.
Response: fault code 1 = Overcurrent

Query:

01	04	00	64	00	01	CRC16
Slave addr	Function	Address HI	Address LO	Number of points HI	Number of points LO	2 bytes

Response:

01	04	02	00	01	CRC16
Slave addr	Function	Byte count	Data HI	Data LO	2 bytes

7.3.4 Parameter Write and Read

Parameters can be read by using the function code 3 and written by using the function code 6. Modbus address according to parameter numbers as follows.

Modbus address	Vacon parameter group	Vacon parameter number
40000 - 40099	Reference	1 - 99
40100 - 40199	Group 1	1 - 99
40200 - 40299	Group 2	1 - 99
.	.	
.	.	
49800 - 49899	Group 98	1 - 99
49900 - 49999	Group 0	1 - 99

Numbering of the parameter as well as parameter ranges and steps can be found in the application manual in question. The parameter value should be given without decimals.

Example 1: Write value 25 to Vacon parameter 3.2
Response is an echo of the query.

Query:

01	06	01	2D	00	19	CRC16
Slave addr	Function	Address HI	Address LO	Data HI	Data LO	2 bytes

Response:

01	06	01	2D	00	19	CRC16
Slave addr	Function	Address HI	Address LO	Data HI	Data LO	2 bytes

Example 2: Read value of Vacon parameter 1.2
Response: Value of parameter 1.2

Query:

01	03	00	65	00	01	CRC16
Slave addr	Function	Address HI	Address LO	Number of points HI	Number of points LO	2 bytes

Response:

01	03	02	00	32	CRC16
Slave addr	Function	Byte count	Value HI	Value LO	2 bytes

7.4 CONNECTIONS (small Modbus Board for Vacon CXS, Vacon CX211OPT)

7.4.1 Board layout

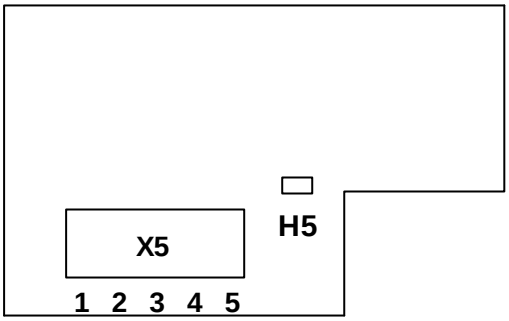


Figure 7-1. Modbus board

Terminals:

X5 Screw terminal to Modbus CXS

Diagnostic LED:

H5 Supply Voltage, Red.
H3 led is active if the Fieldbus board has supply voltage.

7.4.2 Modbus connections

Screw Connector connector X5: (Terminal resistors not included in the package)

Signal	Connector X5	Description
Shield	X5-1	Cable shield
-	X5-2	-
RxD/TxD-P	X5-3	Receive/Transmission data positive (B)
RxD/TxD-N	X5-4	Receive/Transmission data negative (A)
DGND	X5-5	Data Ground

Termination for the last node

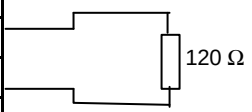
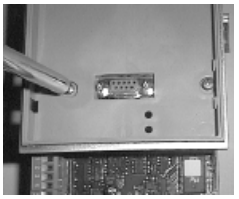
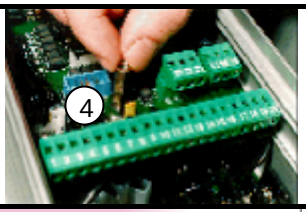
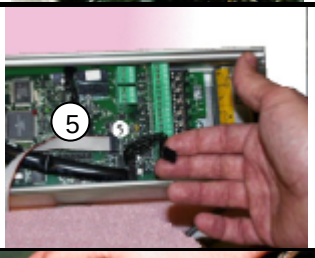
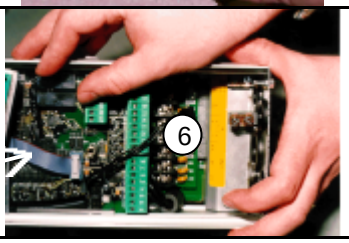
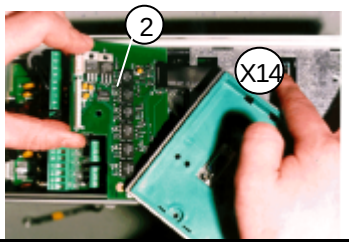
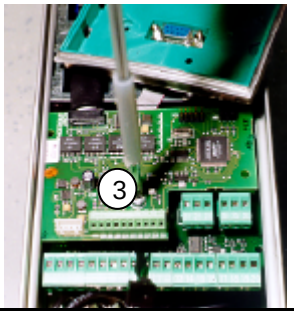


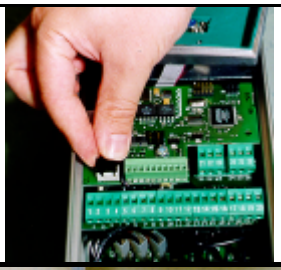
Table 7-2. Screw connector terminals

Note! If Vacon is the last device then the bus termination must be set. Install the resistors to the screw terminal (see table 5-1)

7.5 Installation of CX211OPT in Vacon CXS drives

NOTE: The option boards on the pictures may not look exactly the same as the one you have purchased. These instructions are, still, applicable.

A	Remove the control panel and the panel base.	 
B	Remove the fixing screw from the control board and replace it with a stand sleeve (4).	
C	Connect the power cable (5) to terminal X5 of the control board. The power cable can also be connected to terminal X6 if terminal X5 is already reserved by the power cable from the power board.	
D	Remove the protective foil of the plastic board and place the plastic board above the control board. Be sure to place the plastic board correctly so that the stand sleeve (4) comes out through the hole on the board.	 4
E	Place the board on the protective plastic board (6) and connect the data cable (2) to terminal X14 of the control board. The stand sleeve should come out through the metal-edged hole.	
F	Secure the board on the stand sleeve with the screw (3) attached.	

G	Connect the power cable (5) to terminal X9 on the option board.	
H	Attach the control panel base with four screws.	
I	Check the connections. Remove all foreign objects from inside the frequency drive. Put the control panel and the frequency drive cover back to their places.	

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