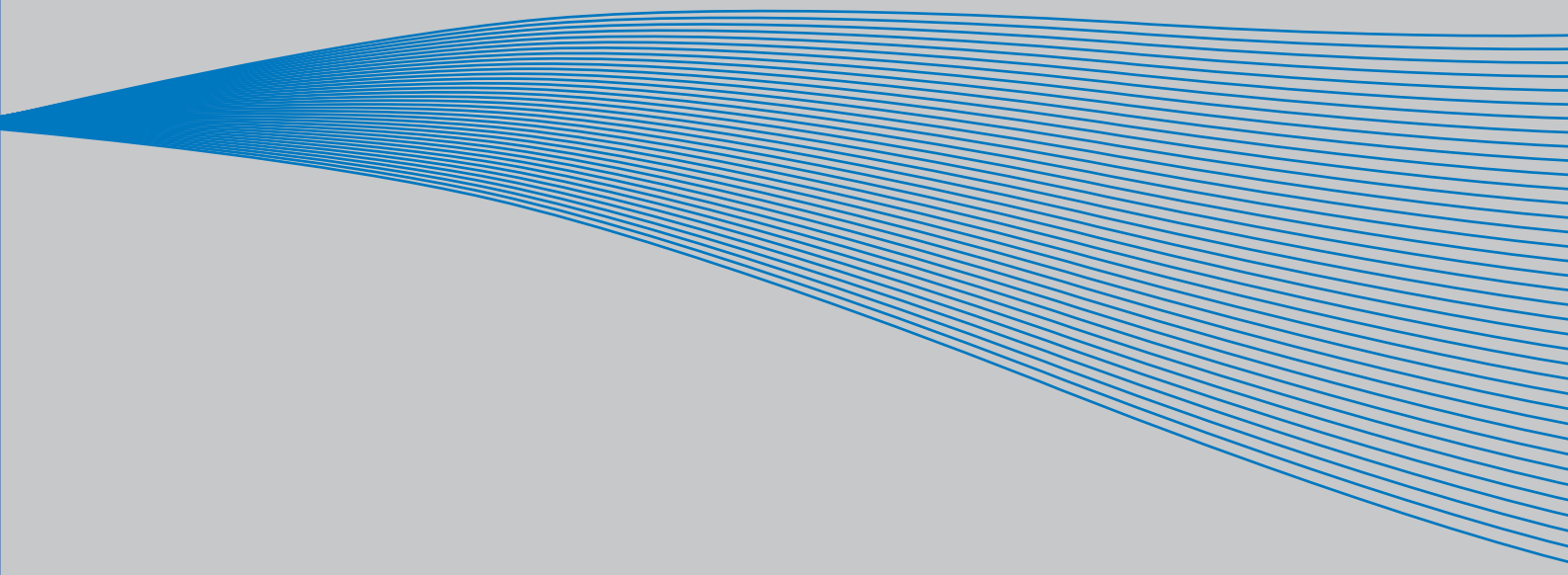
VACON NX
AC DRIVES

OPTC6
CANOPEN OPTION BOARD

USER MANUAL



VACON
DRIVEN BY DRIVES

INDEX

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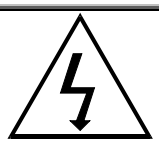
1. GENERAL

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

The CanOpen fieldbus board shall be installed in slot E on the control board of the frequency converter.

 **DANGER**	Internal components and circuit boards are at high potential when the frequency converter is connected to the power source. This voltage is extremely dangerous and may cause death or severe injury if you come into contact with it.

NOTE! When experiencing problems with fieldbus functionalities, please contact **Fieldbus@vacon.com.**

NOTE! You can download the English and French product manuals with applicable safety, warning and caution information from www.vacon.com/downloads.
REMARQUE Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site www.vacon.com/downloads.

2. CANOPEN OPTION BOARD TECHNICAL DATA

2.1 General

CanOpen connections	Interface	Open Style Connector (Pluggable connector, 5.08mm)
	Data transfer method	CAN (ISO 11898)
	Transfer cable	2 wire twisted shielded cable
	Electrical isolation	500 VDC
Communications	CanOpen	CiA DS-301
		CiA DSP-402
	Baud rate	10 kBaud 20 kBaud 50 kBaud 100 kBaud 125 kBaud 250 kBaud 500 kBaud 1000 kBaud
	Addresses	1 – 127
Environment		The specifications of the drive are applicable.
Safety		Fulfils EN50178 standard

Table 2-1. CanOpen technical data

2.2 CanOpen cable

According to the ISO 11898 standard, cables to be chosen for CAN bus lines should have a nominal impedance of 120Ω, and a specific line delay of nominal 5 ns/m. Line termination has to be provided through termination resistors of 120Ω located at both ends of the line. The length related resistance should have 70 mΩ/m. All these mentioned AC and DC parameters are suitable for a 1 Mbit/s transmission rate.

The table below shows practical bus length for CANopen networks with less than 64 nodes:

Baudrate [Kbit/s]	Max. Bus length [m]
1000	30
800	50
500	100
250	250
125	500
50	1000
20	2500

3. CANOPEN

CANopen is a networking system based on the serial bus Controller Area Network (CAN). The CANopen Communication Profile (CiA DS-301) supports both direct access to device parameters and time-critical process data communication. CANopen device profiles (CiA DS-40x) define standards for basic device functionality while providing ample scope for additional vendor-specific device features. CANopen leashes the full power of CAN by allowing direct peer to peer data exchange between nodes in an organised and, if necessary, deterministic manner. The network management functions specified in CANopen simplify project design, implementation and diagnosis by providing standard mechanisms for network start-up and error management.
CANopen supports both-cyclic and event-driven communication. This makes it possible to reduce the bus load to a minimum but still maintaining extremely short reaction times. High communication performance can be achieved at relatively low baud rates, thus reducing EMC problems and minimising cable costs.
CANopen is the ideal networking system for all types of automated machinery. One of the distinguishing features of CANopen is its support for data exchange at the supervisory control level as well as accommodating the integration of very small sensors and actuators on the same physical network. This avoids the unnecessary expense of gateways linking sensor/actuator bus systems with higher communication networks and makes CANopen particularly attractive to original equipment manufacturers.

Device Profile Drives and Motion Control (CiA DSP-402) document represents the standardised CANopen Device Profile for digital controlled motion products like servo controllers, frequency converters or stepper motors. All the above-mentioned devices use communication techniques which conform to those described in the CANopen Application Layer and Communication Profile. The starting and stopping of the drive and several mode specific commands are executed by the statemachine. The operation mode defines the behaviour of the drive. The following modes are defined in this profile:

Homing Mode
Profile Position Mode
Interpolated Position Mode
Profile Velocity Mode
Profile Torque Mode
Velocity Mode

Vacon CanOpen Option Board supports the **Velocity Mode**

4. CANOPEN OPTION BOARD LAYOUT AND CONNECTIONS

Vacon CanOpen Board is connected to the fieldbus through a 5-pin pluggable bus connector (board NXOPTC6).
The communication with the control board of the frequency converter takes place through the standard Vacon Interface Board Connector.

4.1 CanOpen option board

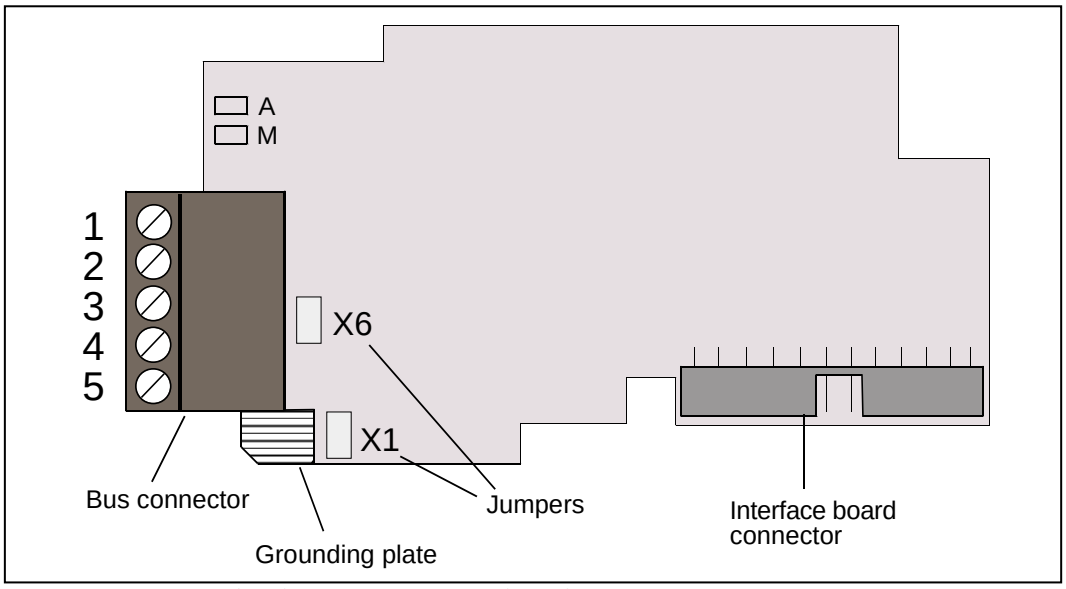


Figure 4-1. Vacon CanOpen option board OPT-C6

Signal	Connector	Description
CAN_GND	1	Ground / 0V / V-
CAN_L	2	CAN_L bus line (dominant low)
(CAN_SHLD)	3	Optional CAN shield
CAN_H	4	CAN_H bus line (dominant high)
(CAN_V+)	5	-

Table 4-1.OPT-C6 bus connector signals

4.2 Bus terminal resistors

If Vacon drive is the last device of the CanOpen line the bus termination must be set. Use jumper X6 (ON position see Figure 4-1), or an external resistor (120Ω) connected to terminals 2 and 4.

4.3 LED indications

The CanOpen Option Board includes two LED status indicators next to the connector: Fieldbus status (M), CanOpen(A). Led N is unused.

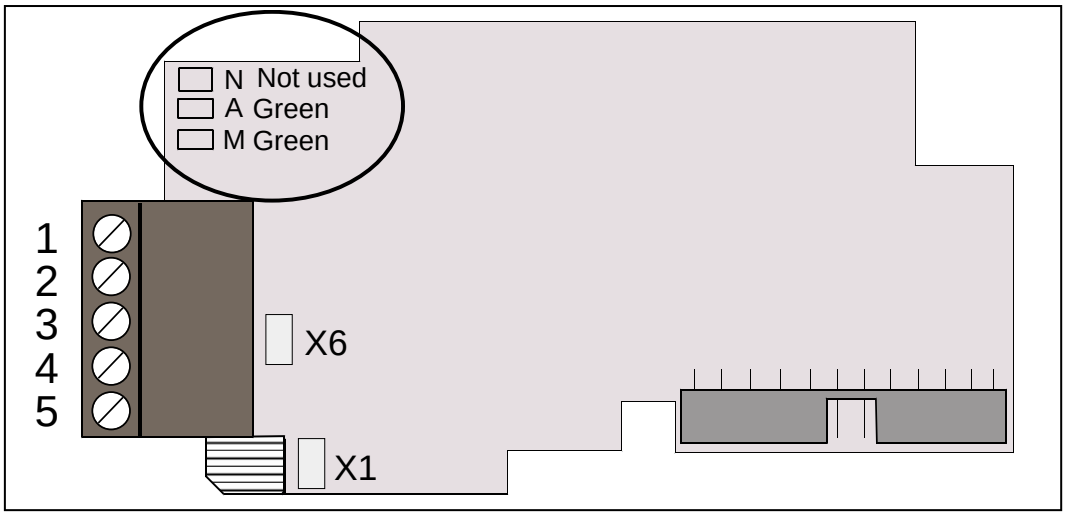


Figure 4-2. LED indications on the CANopen board

CanOpen board status LED (A) GREEN

LED is:	Meaning:
OFF	Option board not activated
ON	Option board in initialisation state waiting for activation command from the frequency converter
Blinking fast (1 blink / s)	Option board is activated and in RUN state Option board is ready for external communication
Blinking slow (1 blink/ 5s)	Option board is activated and in FAULT state Internal fault of option board

Fieldbus status LED (M) GREEN

LED is:	Meaning:
OFF	Fieldbus module is waiting for parameters from the frequency converter No external communication
ON	Fieldbus module is activated Parameters received and module activated Module is waiting for messages from the bus
Blinking fast (1 blink / s)	Module is activated and receiving messages from the bus
Blinking slow (1 blink / 5s)	Module is in FAULT state No messages from Master within the watchdog time Bus broken, cable loose or Master off line

4.4 Connection of CanOpen bus cable

The bus cable shield can be grounded in three different ways:
a) clamping the cable to the frequency converter frame
b) to the frame of the frequency converter through an RC filter
c) directly to the converter frame

Note: Normally, the option board has already been installed in slot E of the control board. It is not necessary to detach the whole board for the grounding of the bus cable shield. Just detach the terminal block.

4.4.1 Grounding by clamping the cable to the converter frame

This manner of grounding is the most effective and especially recommended when the distances between the devices are relatively short (see 4.4.2.1).
In this manner of grounding, the position of jumper X1 is of no importance

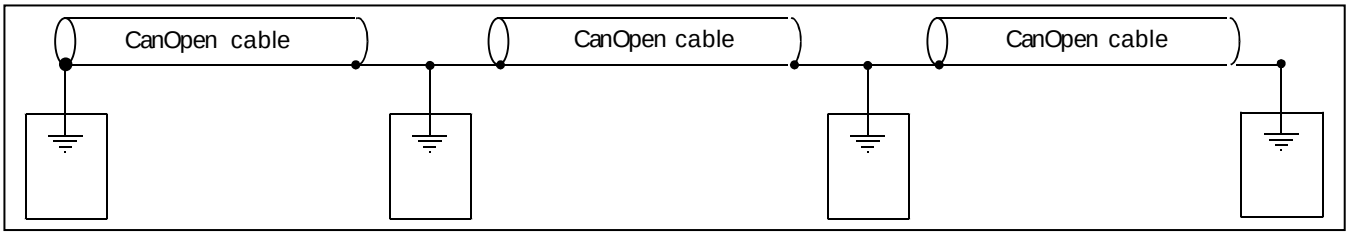


Figure 4-3. Grounding by clamping the cable to the converter frame

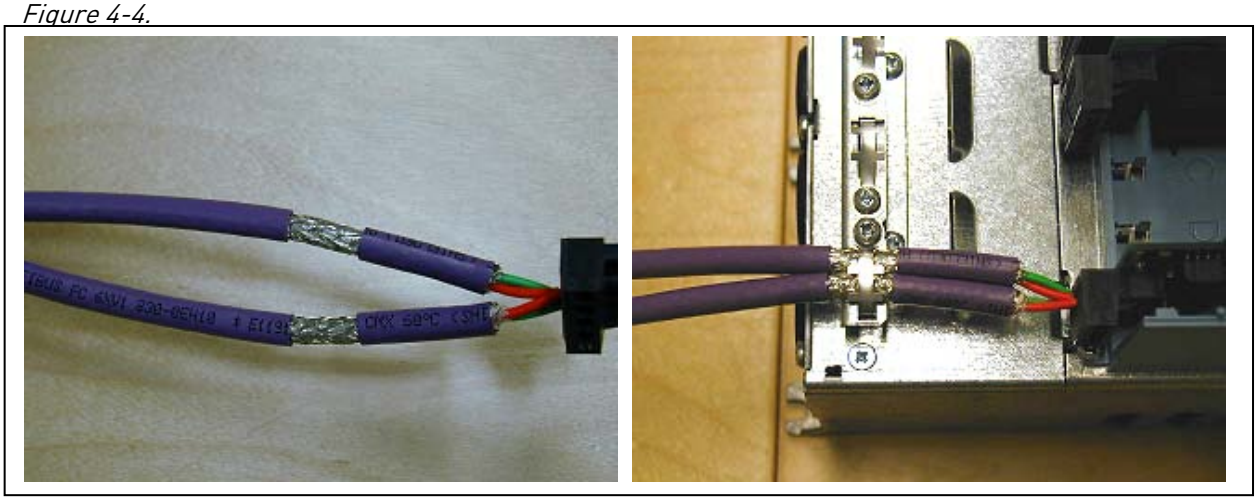
1 Strip about 5 cm of the CanOpen cable in the same way as shown in Figure 4-4 but **cut off the grey cable shield**.
Remember to do this for both bus cables (except for the last device).

2 Leave no more than 1 cm of the data cable outside the terminal block and strip the data cables at about 0.5 cm to fit in the terminals. See Figures 4-5 and 4-6.
Note: Do this for both bus cabels

3 Insert the data cables **of both CanOpen cables** into terminals #2 and #4. See Figure 4-7.

4 Strip the CanOpen cable at such a distance from the terminal that you can fix it to the frame with the grounding clamp. See Figure 4-4.**Error! Reference source not found.**

Figure 4-4.



4.4.2 Grounding the bus cable shield directly to the frequency converter frame using jumper X1

1 Set jumper **X1** in ON position:

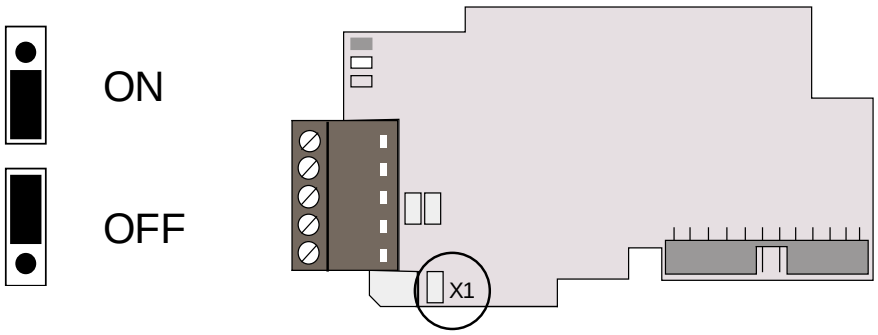


Figure 4-5. Jumper X1 positions

2 Strip about 5 cm of the CanOpen cable as shown in the picture.
Note: Do the same for both bus cables (except for the last device). However, since the grounding shall be done on one cable only cut off the exposed part of the other grounding cable.

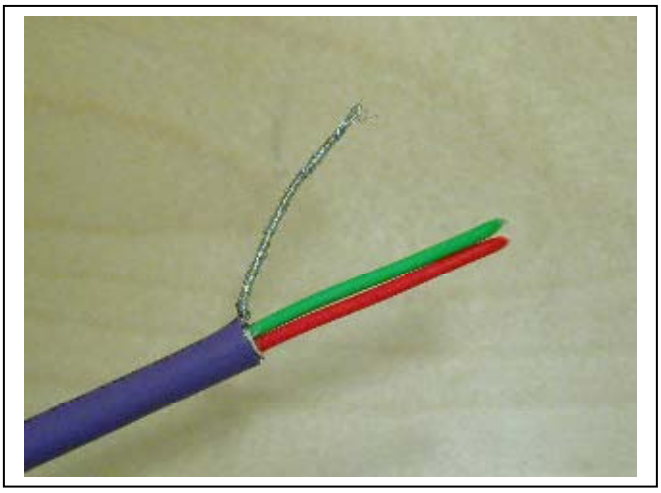


Figure 4-6.

3 Leave no more than 1 cm of the red and green data cable outside the terminal block and strip the data cables at about 0.5 cm to fit in the terminals. See pictures below.
Note: Do this for both bus cabels.

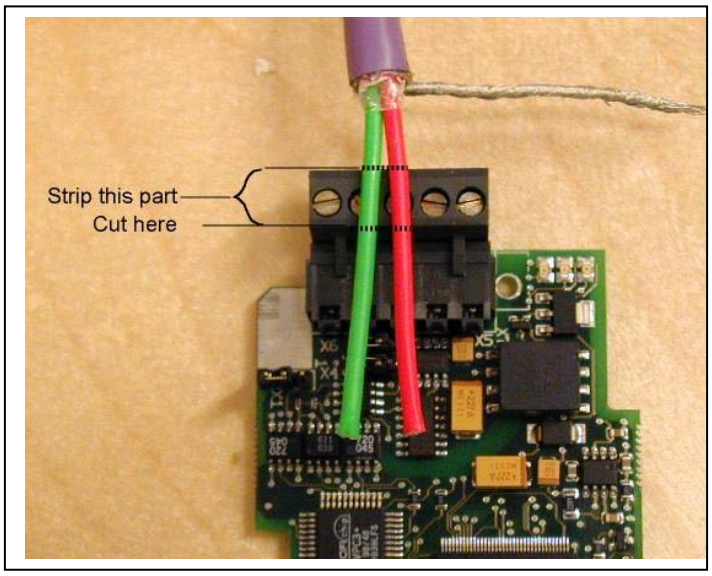


Figure 4-7.

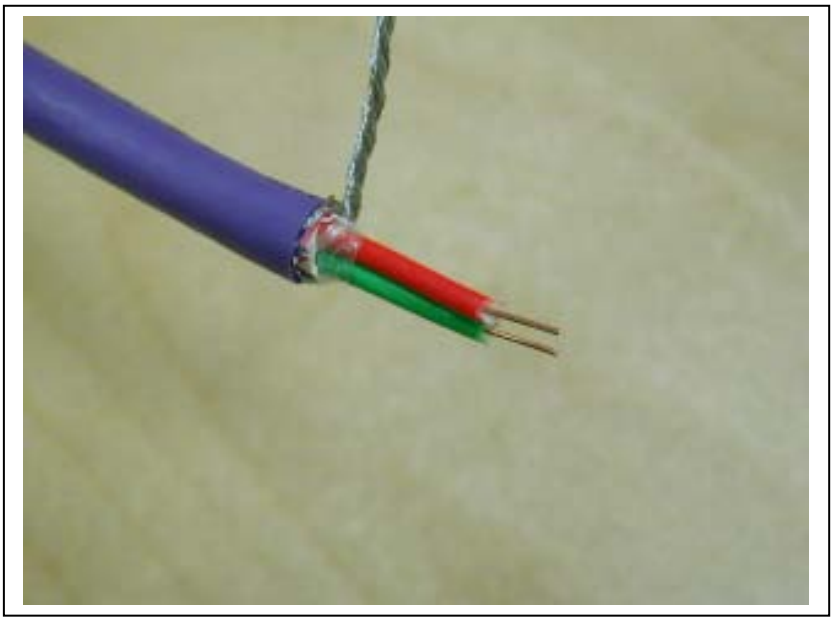


Figure 4-8.

4 We recommend you to use an Abico connector to fit the grounding cable into the grounding terminal (#3).
Insert the white and brown data cables **of both CanOpen cables** into terminals #2 (white) and #4 (brown).

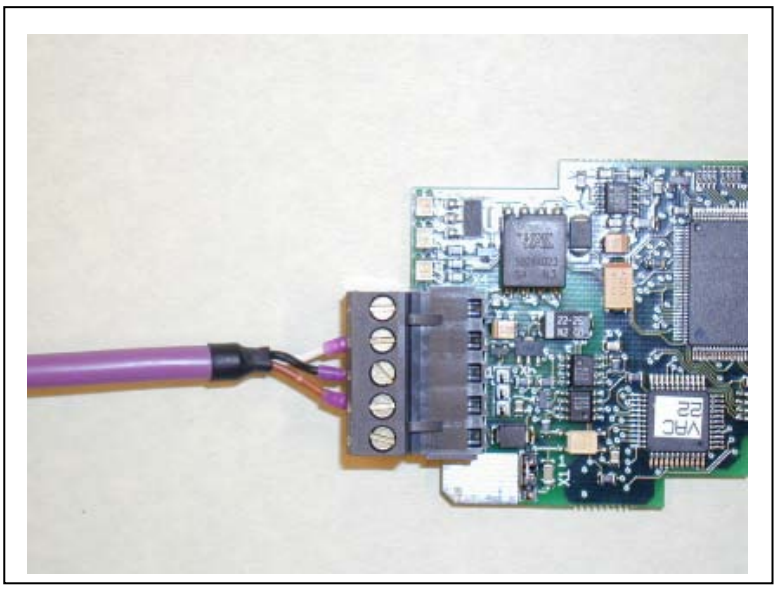


Figure 4-9.

5 Place the CanOpen board into slot E of the control board (see board installation on page 13) and fix both the CanOpen cables on the frame with the clamp.

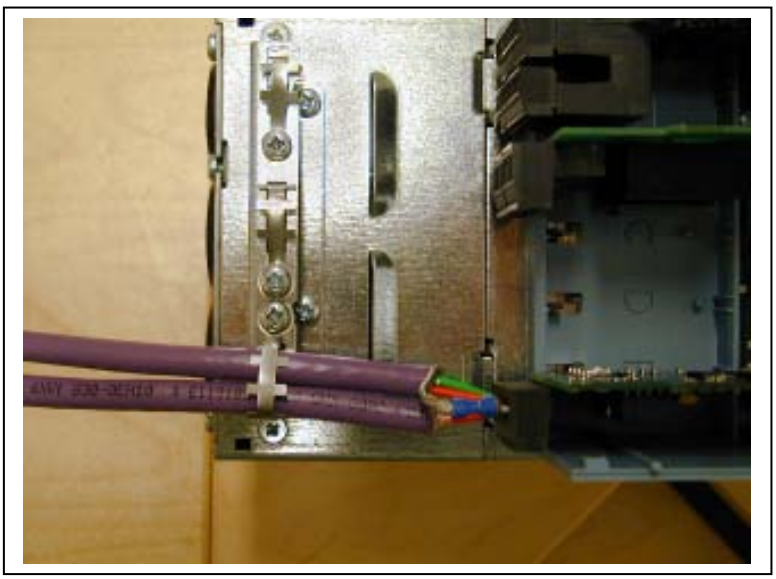


Figure 4-10.

4.4.2.1 Grounding the bus cable shield directly to the frequency converter frame using an RC-filter

We recommend you to do the grounding in this manner when the distance between the devices exceeds 50 meters (55 yds.). When the distance between the devices is long disturbances (e.g. voltage spikes) are more likely to appear. In this grounding method, the disturbances are filtered out. Even if the ground planes of A, B and C are different (which is very typical e.g. in construction) there is no current between them because the points do not have a ground connection.

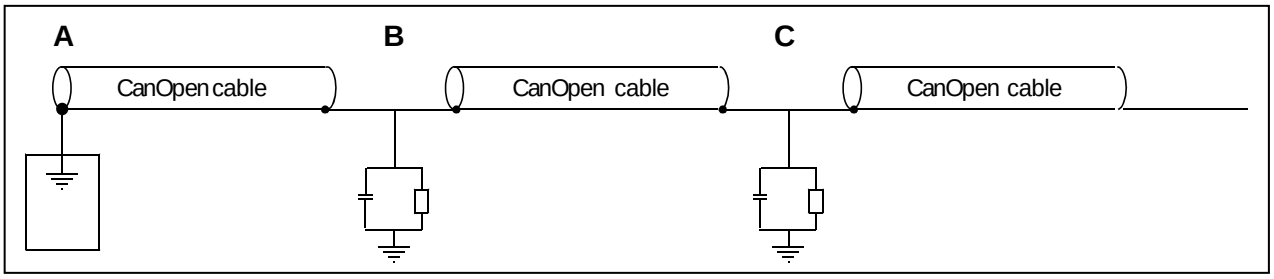


Figure 4-11. Grounding with RC filter

1 Set jumper X1 in OFF position

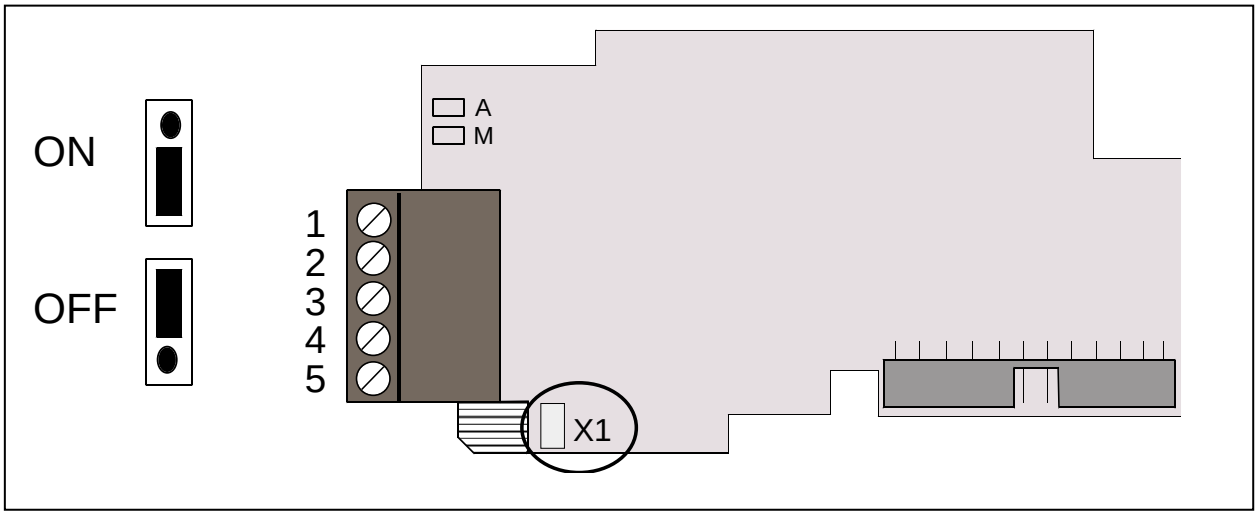


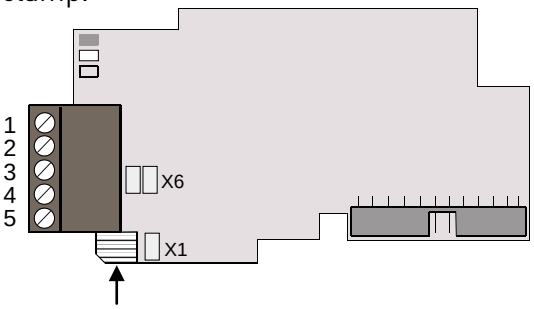
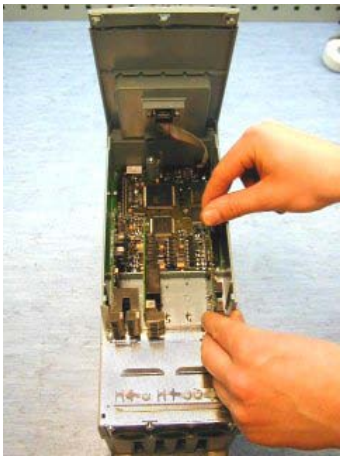
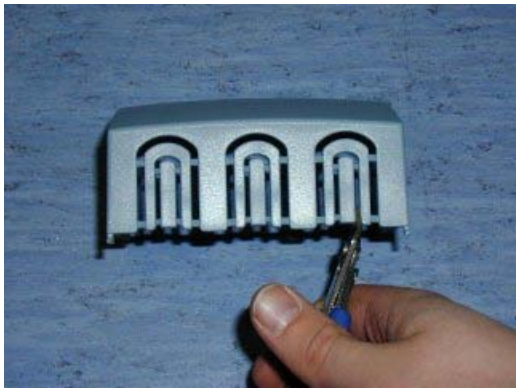
Figure 4-12. Jumper X1 positions

2 Carry out the grounding in the same way as advised in Chapter 4.4.1.

5. INSTALLATION OF VACON NX CANOPEN BOARD

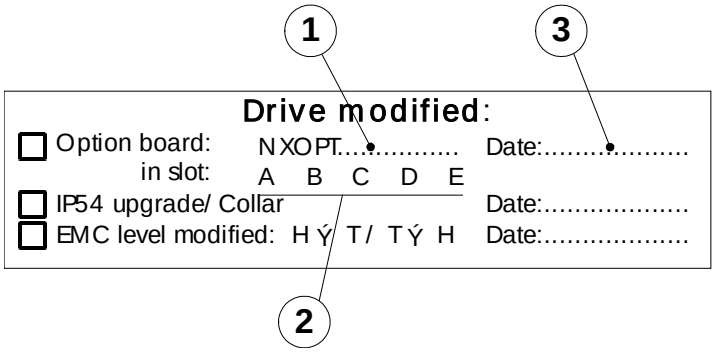
NOTE	MAKE SURE THAT THE FREQUENCY CONVERTER **IS SWITCHED OFF** BEFORE AN OPTION OR FIELDBUS BOARD IS CHANGED OR ADDED!

A	Vacon NX frequency converter	
B	Remove the cable cover.	
C	Open the cover of the control unit.	

D	Install CanOpen option board in slot E on the control board of the frequency converter. Make sure that the grounding plate (see below) fits tightly in the clamp. 	
E	Make a sufficiently wide opening for your cable by cutting the grid as wide as necessary.	
F	Close the cover of the control unit and the cable cover.	

5.1 Board information sticker

The CanOpen option board package delivered by the factory includes a sticker (shown below). Please mark the board type (1), the slot into which the board is mounted (2) and the mounting date (3) on the sticker. Finally, attach the sticker on your drive.



6. COMMISSIONING

READ FIRST CHAPTER 8 'COMMISSIONING' IN VACON NX USER'S MANUAL (Document nr. ud00701, please visit http://www.vacon.com/support/documents.html).
Note! You must select Fieldbus as the active control place, if you wish to control the frequency converter through fieldbus. See Vacon NX User's Manual, Chapter 7.3.3.1
The Vacon CanOpen board is commissioned with the control keypad by giving values to appropriate parameters in menu **M7** (for locating the expander board menu see Vacon NX User's Manual, Chapter 7).

Expander board menu (M7)

The *Expander board menu* makes it possible for the user 1) to see what expander boards are connected to the control board and 2) to reach and edit the parameters associated with the expander board.
Enter the following menu level **(G#)** with the *Menu button right*. At this level, you can browse through slots A to E with the *Browser buttons* to see what expander boards are connected. On the lowermost line of the display you also see the number of parameter groups associated with the board.
If you still press the *Menu button right* once you will reach the parameter group level where there are two groups: Editable parameters and Monitored values. A further press on the *Menu button right* takes you to either of these groups.

CanOpen parameters

To commission the CanOpen board, enter the level P7.5.1.# from the *Parameters* group (G7.5.1). Give desired values to all CanOpen parameters (see xx and xx).

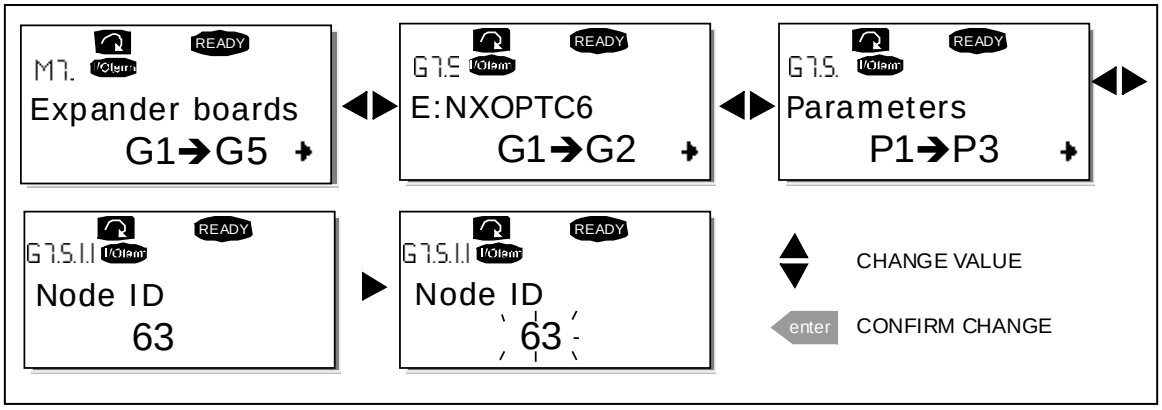


Figure 6-1. Changing the CANopen option board parameters

#	Name	Default	Range	Description
1	Node ID	1	1 – 127	
2	BAUD RATE	6	1 – 10 kBaud 2 – 20 kBaud 3 – 50 kBaud 4 – 100 kBaud 5 – 125 kBaud 6 – 250 kBaud 7 – 500 kBaud 8 – 1000 kBaud	Communication speed
3	Operate mode	1	1 – Drive Profile 2 – ByPass 3 – ByPass 2	Communication set selection 1 = xPDO1, xPDO6 2 = xPDO1, xPDO21, xPDO22 3 = xPDO1, xPDO21, xPDO22

Table 6-1. CANopen parameters

ByPass mode can be used in customer-specific applications and in special applications, such as System Interface application.

ByPass 2 mode is used with standard applications, e.g. NXL Multicontrol application and All-in-One applications for NXS and NXP.

ByPass 2 mode is supported in the following System software versions:

- NXL NXL00005V253
- NXS NXS00001V174
- NXP NXP00002V174

The parameters of every device must be set before connecting to the bus. Especially the parameters "NODE ID" and "BAUD RATE" must be the same as in the master configuration.

CanOpen status

To see the present status of the CanOpen Fieldbus, enter the *CanOpen Status* page from *Monitor menu (G7.5.2)*. See picture and table below.

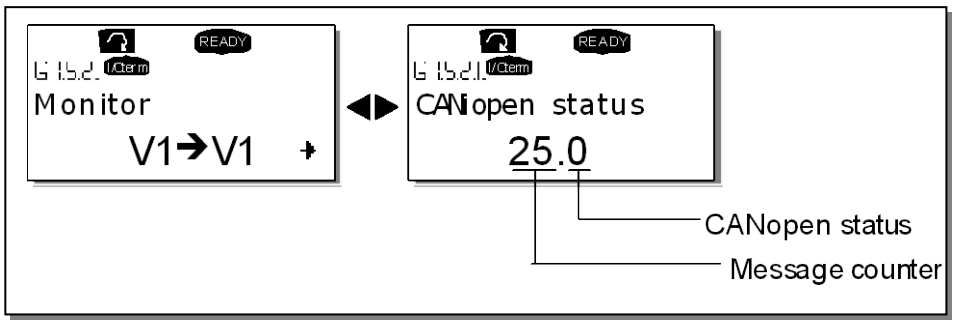


Figure 6-2. DeviceNet status

CanOpen status	
0	INITIALISING
4	STOPPED
5	OPERATIONAL
6	PRE_OPERATIONAL
7	RESET_APPLICATION
8	RESET_COMM
9	UNKNOWN

Table 6-2. CANopen status indications

7. CANOPEN-VACON NX INTERFACE

CanOpen communication objects transmitted via the CAN network are described by services and protocols. They are classified as follows:

- The real-time data transfer is performed by the Process Data Objects (PDOs) protocol
  → REAL-TIME CONTROL OF THE DRIVE
- Service Data Objects (SDO) protocols provide the read and write access to entries of a device object dictionary
  → CONFIGURATION OF THE DRIVE, READ/WRITE DRIVE PARAMETERS
- The Network Management (NMT) protocols provide services for network initialization, error control and device status control
  → START/STOP CANOPEN COMMUNICATION

7.1 CanOpen message frame

SOF	**COB-ID**	RTR	CTRL	**Data Segment**	CRC	ACK	EOF
1bit	**11bit**	1bit	5bit	**0-8bytes**	16bits	2bits	7bits

SOF Start of Frame
RTR Remote Transmission Request
CTRL Control Field (i.e. Data Length)
CRC Cyclic Redundancy Check
ACK Acknowledge
EOF End of Frame

COB-ID

The identification field of the CANopen-message is 11 bits.

ID-Bit	10	9	8	7	6	5	4	3	2	1	0
COB-ID	Function Code				Module-ID						

The default identification field consists of a functional part and a module-ID part. The functional part determines the object priority. This kind of identification field allows communication between a master and 127 slaves. Broadcasting is indicated by a module-id of zero. Function codes are determined with object dictionaries in device profiles.

Predefined connection sets

CanOpen option board has two different communication parameter sets. These sets can be selected via Operate Mode –parameter from panel. Both communication sets fullfils 'Drives And Motor Control'-profile described in CiA DSP-402.

Drive Profile - mode			
Object	**Function Code (binary)**	**COB-ID**	**Comm. parameter at Index**
NMT message	0000	0x0000	-
Sync Message	0001	0x0080	0x1005
Time-Stamp-Message	0001	0x0100	-
PDO1, Process Data Objects (tx)	0011	0x0180 +Node	0x1800
PDO1, Process Data Objects (rx)	0100	0x0200 +Node	0x1400
PDO6, Process Data Objects (tx)	0101	0x0280 +Node	0x1801
PDO6, Process Data Objects (rx)	0110	0x0300 +Node	0x1401
SDO, Service Data Objects (tx)	1011	0x0580 +Node	
SDO, Service Data Objects (rx)	1100	0x0600 +Node	
Node Guarding	1110	0x0700 +Node	(0x100E)

Table 7-1. Drive Profile -mode

ByPass - mode			
Object	**Function Code (binary)**	**COB-ID**	**Comm. parameter at Index**
NMT message	0000	0x0000	-
Sync Message	0001	0x0080	0x1005
Time-Stamp-Message	0010	0x0100	-
PDO1, Process Data Objects (tx)	0011	0x0180 +Node	0x1800
PDO1, Process Data Objects (rx)	0100	0x0200 +Node	0x1400
PDO21, Process Data Objects (tx)	0111	0x0380 +Node	0x1814
PDO21, Process Data Objects (rx)	1000	0x0400 +Node	0x1414
PDO22, Process Data Objects (tx)	1001	0x0480 +Node	0x1815
PDO22, Process Data Objects (rx)	1010	0x0500 +Node	0x1415
SDO, Service Data Objects (tx)	1011	0x0580 +Node	
SDO, Service Data Objects (rx)	1100	0x0600 +Node	
Node Guarding	1110	0x0700 +Node	(0x100E)

Table 7-2. Bypass -mode

7.2 Network Management (NMT)

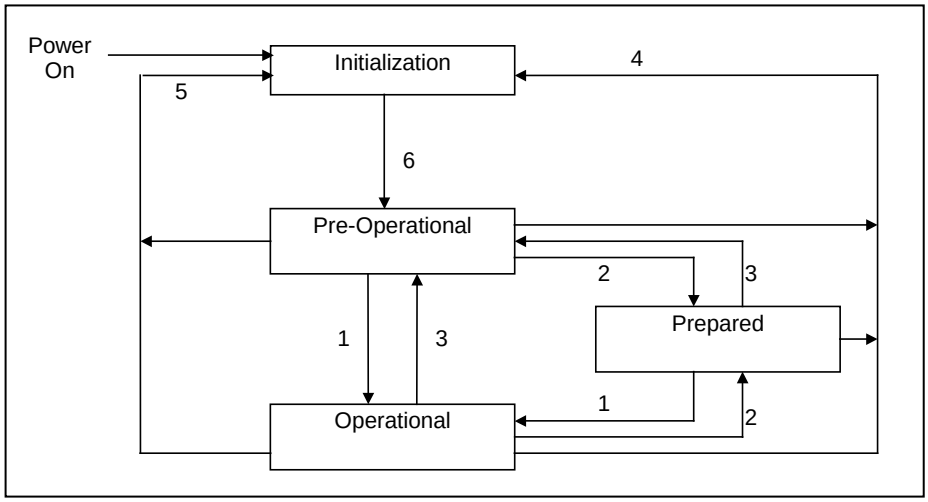
The CanOpen network management is node-oriented and follows a master/slave structure. It requires one device in the network, which fulfills the function of the NMT master. The other nodes are NMT slaves.
The CanOpen NMT slave devices implement a state machine, see picture below. After power on a node initialises and transits to the "Pre-operational State". In this state communication across SDO channels is possible for node configuration, but not yet across PDOs. With the NMT message "Start Remote Node", a selected or any nodes on the network can be set into the "Operational State". In this state, also the exchange of data by means of PDOs is possible. With enabling the operation of all nodes of a network at the same time, a co-ordinated operation of the communicating system is secured (DS301).
To Set Vacon CanOpen Option board to the "Operational State" the following message must be sent:

Message: Start_Remote_Node

Master to Slave (1)

Header			Data							
ID	RTR	Len	1 = **CS**	2 = Node ID	3	4	5	6	7	8
0000	0	2	01	01						

Function of the internal state machine:



Change	Message / Event	Command Specifier (CS)
1	Start Remote Node	CS = 1
2	Stop Remote Node	CS = 2
3	Enter Pre-operational State	CS = 128
4	Reset Node	CS = 129
5	Reset Communication	CS = 130
6	Initialisation finished	Automatic

7.3 Process data (PDO)

The real-time data transfer is performed by means of "Process Data Objects" (PDO). The transfer of PDOs is performed with no protocol overhead. Process Data is time-critical data used for control of the drive and monitor status of the drive. Transmit PDOs support several transmission modes which are cyclic, acyclic, synchronous, asynchronous and RTR only mode. Most PDOs support also Event Timer for transmitting PDOs. TPDO1 is exception which is defined for asyncronous only operation. Receive PDOs support only asyncronous transmission mode (event driven). Vacon CanOpen option board uses 8 types of PDOs as follows:

PDO Type	Mapped Data	Mapped Data	Mapped Data	Mapped Data	Cyclic	Acyclic	Synchronous	Asynchronous (default	RTR Only mode	Event Timer
TPDO1	statusword	-	-	-				**x**		
TPDO6	statusword	vl_control_effort	-	-	X	X	X	**x**	X	X
TPDO21	nx_status_word	nx_actual_speed	process_data_out 1	process_data_out 2	X	X	X	**x**	X	X
TPDO22	process_data_out3	process_data_out4	process_data_out5	process_data_out6	X	X	X	**x**	X	X
RPDO1	controlword	-	-	-				**x**		
RPDO6	controlword	vl_target_velocity	-	-				**x**		
RPDO21	nx_control_word	nx_speed_reference	process_data_in1	process_data_in2				**x**		
RPDO22	process_data_in3	process_data_in4	process_data_in5	process_data_in6				**x**		

Note: manufacturer specific PDOs (TPDO21/RPDO21/ TPDO22/RPDO22) consist of application specific process data. See appendix for contents of these processdatas in different applications. See Chapter 7.6 (Using manufacturer specific PDOs) or a specific application manual.

Note! all Tx objects are event-driven by default. (Message is sent out if one or several values within the message change)

7.4 Transmission types

transmission type	PDO transmission				
	cyclic	acyclic	synchronous	asynchronous	RTR only
0		X	X		
1-240	X		X		
241-251	- Reserved -				
252			X		X
253				X	X
254				X	
255				X	

Table 7-3. Description of transmission type

Synchronous (transmission types 0-240 and 252) means that the transmission of the PDO shall be related to the SYNC object. Preferably the devices use the SYNC as a trigger to output or actuate based on the previous synchronous Receive PDO respectively to update the data transmitted at the following synchronous Transmit PDO. Asynchronous means that the transmission of the PDO is not related to the SYNC object. A transmission type of zero means that the message shall be transmitted synchronously with the SYNC object but not periodically. A value between 1 and 240 means that the PDO is transferred synchronously and cyclically. The transmission type indicating the number of SYNC which are necessary to trigger PDO transmissions. Receive PDOs are always triggered by the following SYNC upon reception of data independent of the transmission types 0 - 240.

The transmission types 252 and 253 mean that the PDO is only transmitted on remote transmission request. At transmission type 252, the data is updated (but not sent) immediately after reception of the SYNC object. At transmission type 253 the data is updated at the reception of the remote transmission request (hardware and software restrictions may apply). These value are only possible for TPDOs. For TPDOs transmission type 254 means, the application event is manufacturer specific (manufacturer specific part of the Object Dictionary), transmission type 255 means, that the application event is defined in the device profile. RPDOs with that type trigger the update of the mapped data with the reception. PDOs Sub-index 3h contains the inhibit time. This time is a minimum interval for PDO transmission. The value is defined as multiple of 100µs. It is not allowed to change the value while the PDO exists (Bit 31 of sub-index 1 is 0).

In mode 254/255 additionally an event time can be used for TPDO. If an event timer exists for a TPDO (value not equal to 0) the elapsed timer is considered to be an event. The event timer elapses as multiple of 1 ms of the entry in sub-index 5h of the TPDO. This event will cause the transmission of this TPDO in addition to otherwise defined events. The occurence of the events set the timer. Independent of the transmission type the RPDO event timer is used recognize the expiration of the RPDO.

7.5 Controlling the drive via PDO messages with Drive Profile

PDO1 Rx

Master to Slave (1)

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x201	0	2	***controlword***		-	-	-	-	-	-

PDO1 Tx

Slave (1) to Master

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x181	0	2	***statusword***		-	-	-	-	-	-

PDO6 Rx

Master to Slave (1)

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x301	0	4	***controlword***		***vl_target_velocity***		-	-	-	-

PDO6 Tx

Slave (1) to Master

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x281	0	4	***statusword***		***vl_control_effort***		-	-	-	-

The state of the drive can be controlled by the *controlword*
The state of the drive is shown in the *statusword.*

The *Statemachine* describes the device status and the possible control sequency of the drive.

controlword

bit	*Name*
0	Switch ON
1	Disable Voltage
2	Quick Stop
3	Enable Operation
4	Operation Mode Specific
5	Operation Mode Specific
6	Operation Mode Specific
7	Reset Fault
8	Halt
9	Reserved
10	Reserved
11	Manufacturer Specific
12	Manufacturer Specific
13	Manufacturer Specific
14	Manufacturer Specific
15	Manufacturer Specific

statusword

bit	*Name*
0	Ready to Switch ON
1	Switched ON
2	Operation Enable
3	Fault
4	Voltage Disable
5	Quick Stop
6	Swich ON Disable
7	Warning
8	Manufacturer Specific
9	Remote
10	Target Reached
11	Internal Limit Active
12	Operation Mode Specific
13	Operation Mode Specific
14	Manufacturer Specific
15	Manufacturer Specific

By using a controlword the drive can be controlled as follows:

Command	ControlWord	Description
Prepare READY	0006hex	Set Statemachine to "Ready To Switch ON" state
Prepare RUN	0007hex	Set Statemachine to "Switched ON" state
RUN	000Fhex	Start motor if "Fieldbus" is the active control place
STOP	0007hex	Stop motor
FAULT RESET (step 1) FAULT RESET (step 2)	bit 7 = 0 bit 7 = 1	Rising edge to bit 7

vl_target_velocity

The vl_target_velocity is the required speed reference to the frequency converter.
The unit is RPM.

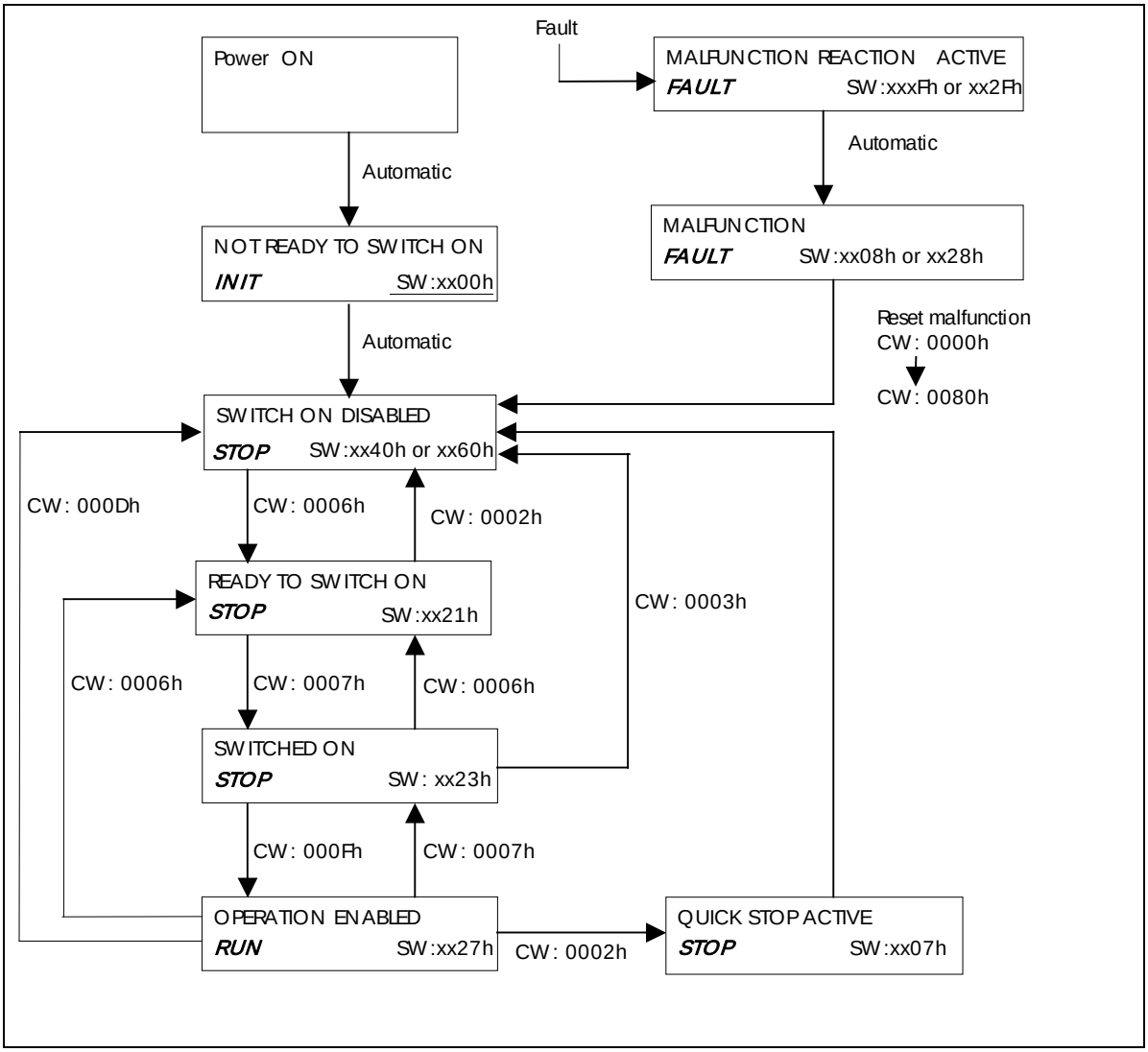
vl_control_effort

The vl_control_effort is the actual speed of the motor.
The unit is RPM.

State Machine

The state machine describes the device status and the possible control sequence of the drive. The state transitions can be generated by using "controlword". The "status word" parameter indicates the current status of state machine. The modes *INIT*, *STOP*, *RUN* and *FAULT* correspond to the actual mode of the Drive.

SW = StatusWord CW = ControlWord word



7.6 Using manufacturer specific PDOs with ByPass modes

Manufacturer specific PDOs are in use when 'Operate Mode' parameter in panel is set to ByPass or ByPass 2. For communication set used in ByPass –modes, seeTable 7-2. Manufacturer specific PDOs are TPDO21, TPDO22, RPDO21 and RPDO22.

PDO21 Rx

Master to Slave (1)

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x401	0	8	***nx_control_word***		***nx_speed_referense***		***process_data_in1***		***process_data_in2***	

PDO21 Tx

Slave (1) to Master

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x381	0	8	***nx_status_word***		***nx_actual_speed***		***process_data_out1***		***process_data_out2***	

PDO22 Rx

Master to Slave (1)

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x501	0	8	***process_data_in3***		***process_data_in4***		***process_data_in5***		***process_data_in6***	

PDO22 Tx

Slave (1) to Master

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x481	0	8	***process_data_out3***		***process_data_out4***		***process_data_out5***		***process_data_out6***	

Controlling drive

NOTE: some Vacon applications may use "Bypass mode" for an enhanced implementation of "Velocity mode" rather than for a manufacturer specific interface. Please refer to the specific application manual for details

The Reference to the drive can be set also via manufacturer specific Process Data Object 21 (rx) when option board is set to ByPass or ByPass 2. In the application, the value is scaled in percentage of frequency area between the set minimum and maximum frequencies.

nx_control_word, used only with ByPass 2 mode. When ByPass mode is used, check more detailed Control Word in the application manual

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	-	-	-	-	-	RST	DIR	RUN

In Vacon applications, the three first bits of the control word are used to control the frequency converter. However, you can customise the content of the control word for your own applications because the control word is sent to the frequency converter as such.

Bit	Description	
	Value = 0	*Value = 1*
0	Stop	Run
1	Clockwise	Counterclockwise
2	Rising edge of this bit will reset active fault	
3....15	Not in use	Not in use

nx_speed_reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

This is the Reference 1 to the frequency converter. Used normally as Speed reference. The allowed scaling is –10000...10000. In the application, the value is scaled in percentage of the frequency area between the set minimum and maximum frequencies.

Processdata_in1 ... Processdata_in6

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

These are application specific process data. See APPENDIX C for content of these process data in different applications.

7.7 Drive Monitoring

Several drive actual values/parameters can be monitored by using manufacturer specific PDOs.

nx_speed_reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

This is the reference 1 to the frequency converter. Used normally as Speed reference.
The allowed scaling is 0..10000. In the application, the value is scaled in percentage of the frequency area between set minimum and maximum frequency.

nx_status_word, used only with ByPass 2 mode. When ByPass mode is used, check more detailed Status Word in the application manual

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	UVFS	DDIR	TCSPDL	FR	Z	AREF	W	FLT	DIR	RUN	RDY

Information about the status of the device and messages is indicated in the *Status word*. The *Status word* is composed of 16 bits that have the following meanings:

Bit	Description	
	Value = 0	*Value = 1*
0	Not Ready	Ready
1	STOP	RUN
2	Clockwise	Counterclockwise
3	-	Faulted
4	-	Warning
5	Ref. frequency not reached	Ref. Frequency reached
6	-	Motor is running at zero speed
7	Flux Ready	Flux Not Ready
8	TC Speed Limit Active (depends on drive model)	TC Speed Limit Not Active (depends on drive model)
9	Detected Encoder Direction Clockwise (depends on drive model)	Encoder Direction Counterclockwise (depends on drive model)
10	UV Fast Stop Active (depends on drive model)	UV Fast Stop Not Active (depends on drive model)
11...15	Not In use	Not In use

Table 7-4. Status word bit descriptions

Processdata_out1 ... Processdata_out6

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

These are application specific process data. See APPENDIX C for content of these process data in different applications.

7.8 Anyparameter service

SDO protocol can be used to read any parameter or actual value and write any parameter from drive. These parameters are read from drive with it's ID number specified in user manual. There are three index in object dictionary as follow for anyparameter service.

Index	Description	Size	Type	Hi 16b	Low 16b
2000	AnyparameterReadID	U16	RW	-	Read ID
2001	AnyparameterReadValue	U32	RO	Status	Value
2002	AnyparameterWrite	U32	RW	ID	Write Value

Reading anyparameter

Writing new value to index 2000 will trigger read event, while read is in process index 2001 is zero. Read event will return value to index 2001. If read is succes status will get value of ID and Value is value of ID. If read fails Status will get value 0xFFFF (dec 65535).

Writing anyparameter

When new ID and value is written to index 2002 a write event will be triggered. Index 2002 value will remain as long as writing is processed (normal sdo/pdo operation during this time). If write is succes index 2002 ID and value will be cleared and new write is possible. If write fails ID will clamp to 0xFFFF and value zero.

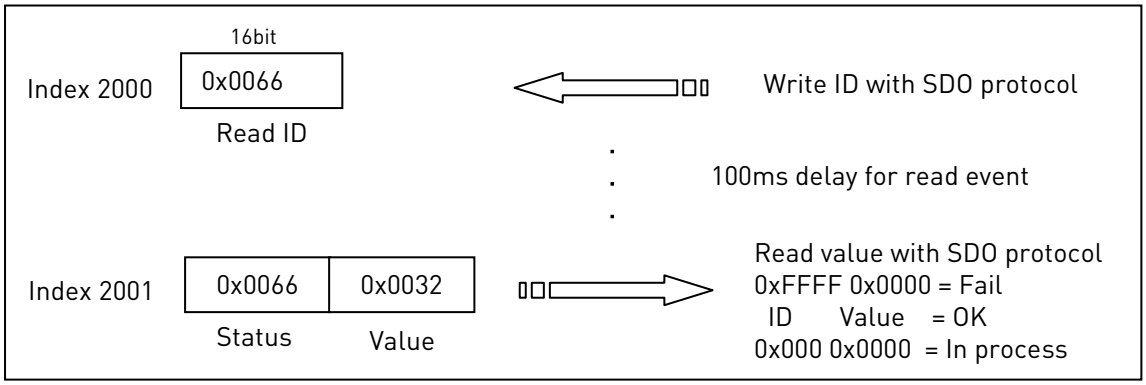


Figure 7-1. Reading Any Parameter

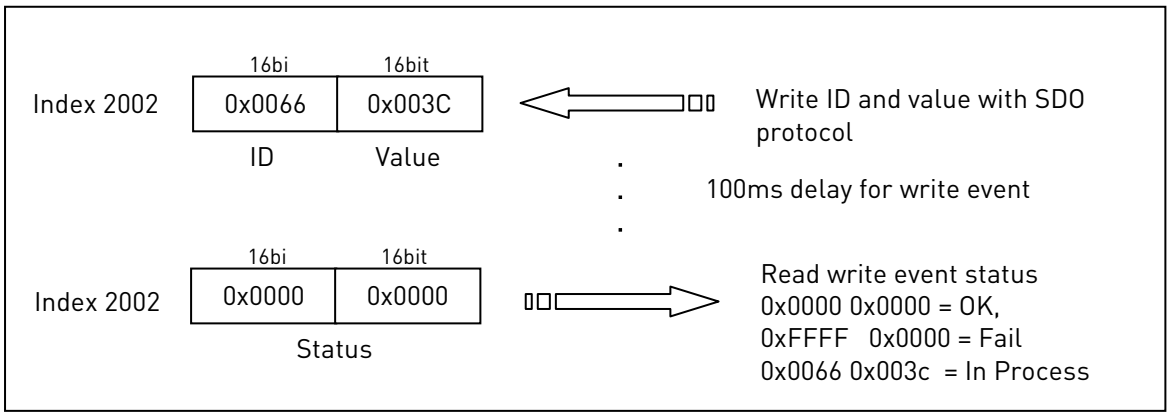


Figure 7-2. Writing Any Parameter

8. SERVICE DATA (SDO)

With service Data Objects (SDOs) the access to entries of a device Object Dictionary is provided. Via SDO all items from object dictionary can be read/written.
Service Data Objects (SDO)s are normally used for device configuration such as setting device parameters. They are also used to define the type and format of information communicated using the Process Data Objects. CanOpen Configuration tools with EDS-files can be used for that purpose. The construction and the method of operation of the SDOs can be found in the CanOpen (DS301) Communication Profile document. Appendix B consist of short description of the SDOs used with Vacon CanOpen option Board.

Object Dictionary

Index		Name	Type	Attr.
hex	dec			
1000	4096	device_type	*Unsigned32*	*CO*
1001	4097	error_register	*Unsigned8*	*RO*
1003	4099	pre defined error field	*Unsigned32*	*RO*
1005	4101	cob-id sync message	*Unsigned32*	*RO*
100C	4108	guard_time	*Unsigned32*	*RW*
100D	4109	life_time_factor	*Unsigned32*	*RW*
1018	4120	Identity Object	*Identity*	
1200	4608	1st_server_SDO_parameter	*SDOParameter*	
1400	5120	1st_receive_PDO_parameter	*PDOCommPar*	
1405	5125	6st_receive_PDO_parameter	*PDOCommPar*	
1414	5140	21st_receive_PDO_parameter	*PDOCommPar*	
1415	5141	22st_receive_PDO_parameter	*PDOCommPar*	
1600	5632	1st_receive_PDO_mapping	*PDOMapping*	
1605	5637	6st_receive_PDO_mapping	*PDOMapping*	
1614	5652	21st_receive_PDO_mapping	*PDOMapping*	
1615	5653	22st_receive_PDO_mapping	*PDOMapping*	
1800	6144	1st_transmit_PDO_parameter	*PDOCommPar*	
1805	6149	6nd_transmit_PDO_parameter	*PDOCommPar*	
1814	6164	21nd_transmit_PDO_parameter	*PDOCommPar*	
1815	6165	22nd_transmit_PDO_parameter	*PDOCommPar*	
1A00	6656	1st_transmit_PDO_mapping	*PDOMapping*	
1A05	6661	6st_transmit_PDO_mapping	*PDOMapping*	
1A14	6676	21st_transmit_PDO_mapping	*PDOMapping*	
1A15	6677	22st_transmit_PDO_mapping	*PDOMapping*	
2000	8192	AnyParameterReadID	*Interger16*	*RW*
2001	8193	AnyParameterReadValue	*Interger32*	*RO*
2002	8194	AnyParameterWrite	*Interger32*	*RW*
2003	8195	nx_current_percentage	*Interger16*	*RO*
2004	8196	nx_torque_percentage	*Interger16*	*RO*
2063	8291	nx_fault_code	*Interger16*	*RO*
27D1	10193	NX control word	*Interger16*	*RW*
27D3	10195	NX speed reference	*Interger16*	*RW*
27D4	10196	Process data in1	*Interger16*	*RW*
27D5	10197	Process data in2	*Interger16*	*RW*
27D6	10198	Process data in3	*Interger16*	*RW*
27D7	10199	Process data in4	*Interger16*	*RW*
27D8	10200	Process data in5	*Interger16*	*RW*
27D9	10201	Process data in6	*Interger16*	*RW*
2836	10294	NX status word	*Interger16*	*RO*
2838	10296	NX actual speed	*Interger16*	*RO*
2839	10297	Process data out1	*Interger16*	*RO*

283A	10298	Process data out2	*Interger16*	*RO*
283B	10299	Process data out3	*Interger16*	*RO*
283C	10300	Process data out4	*Interger16*	*RO*
283D	10301	Process data out5	*Interger16*	*RO*
283E	10302	Process data out6	*Interger16*	*RO*
6040	24640	controlword	*Unsigned16*	*RW*
6041	24641	statusword	*Unsigned16*	*RO*
6042	24642	vl_target_velocity	*Interger16*	*RW*
6043	24643	vl_velocity_demand	*Interger16*	*RO*
6044	24644	vl_control_effort	*Interger16*	*RO*
6046	24646	vl_velocity_min_max_amount	*Unsigned32*	*RW*
6048	24648	vl_velocity_acceleration	*Ramp*	*RW*
6049	24649	vl_velocity_deceleration	*Ramp*	*RW*
604A	24650	vl_velocity_quick_stop	*Ramp*	*RW*
604E	24654	vl_velocity_reference	*Unsigned32*	*RW*
6060	24672	modes_of_operation	*Interger8*	*RO*
6061	24673	modes_of_operation_display	*Interger8*	*RO*

Description of the Object Dictionary

Abbreviations

ro	- read only	i16	- Integer8
wo	- write only	i32	- Integer8
rw	- read write	u8	- Unsigned8
co	- constant	u16	- Unsigned16
bool	- Boolean	u32	- Unsigned32
i8	- Integer8	float	- Floating Point

Index (HEX)	Sub-Index	Name	Default Min Max	Type Attr.	Descriptions
General Parameters					
1000	00	Device Type	0x00010192 0x00000000 0xFFFFFFFF	u32 co	The device type specifies the kind of device. The lower 16 bits contain the device profile number and the upper 16 bits an additional information.
1001	00	Error Register	0x00 0x00 0xFF	u8 ro	The error register is a field of 8 bits, each for a certain error type. If an error occurs the bit has to be set. Bit Meaning 0 generic error 1 current 2 voltage 3 temperature 4 communication error (overrun, error state) 5 device profile specific 6 reserved 7 manufacturer specific
1003		Pre-defined Error Field			This object holds errors that have occurred on the device and have been signalled via Emergency Object. It is an error history. Writing value 0 to sub index 0 deletes the entire error history.
	00	Number of Errors	0x0000 0x0000 0x00FE	u8 rw	
	01	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	02	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	03	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	04	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	05	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	06	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	07	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	08	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
	09	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	

	0A	Standard Error Field	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
1005	00	cob-id sync message	0x80000080 0x00000001 0xFFFFFFFF	u32 ro	cob-id used for syncronize PDO messages
100C	00	Guard Time	0x03E8 0x0000 0xFFFF	u16 rw	This entry contains the guard time in milliseconds. It is 0, if not used. Unit: ms
100D	00	Life Time Factor	0x02 0x00 0xFF	u8 rw	The life time factor multiplied with the guard time gives the life time for the device. It is 0, if not used.
1018		Identity Object			This object contains general information about the device.
	00	Number of entries	0x4 0x1 0x4	u8 ro	
	01	Vendor Id	0x00000090 0x0 0xFFFFFFFF	u32 ro	Sub-Index 1 contains a unique value allocated each manufacturer.
	02	Product Code	0x00000119 0x0 0xFFFFFFFF	u32 ro	Sub-Index 2 identifies the manufacturer specific product code (device version).
	03	Revision number	0x00000001 0x0 0xFFFFFFFF	u32 ro	Sub-Index 3 contains the revision number. Bit 31-16 is the major revision number and Bit 15-0 the minor revision number.
	04	Serial number	0x0 0x0 0xFFFFFFFF	u32 ro	Sub-Index 4 identified a manufacturer specific serial number.
Server SDO Parameters					
1200		Server SDO Parameter			The object contains the parameters for the SDOs for which the device is the server.
	00	Number of Entries	0x02 0x02 0x02	u8 ro	
	01	COB-ID Client -> Server	0x600+NodeID 0x00000601 0xFFFFFFFF	u32 ro	
	02	COB-ID Server -> Client	0x580+NodeID 0x00000581 0xFFFFFFFF	u32 ro	
Receive PDO Communication Parameters					
1400		Receive PDO 1 Communication Parameter			It contains the communication parameters of the first PDO the device is able to receive.
	00	Number of Entries	0x02 0x02 0x05	U8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x200+NodeID 0x00000201 0xFFFFFFFF	U32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 ro	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)
1405		Receive PDO 6 Communication Parameter			It contains the communication parameters of the second PDO the device is able to receive.
	00	Number of Entries	0x02 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x300+NodeID 0x00000301 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 ro	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)

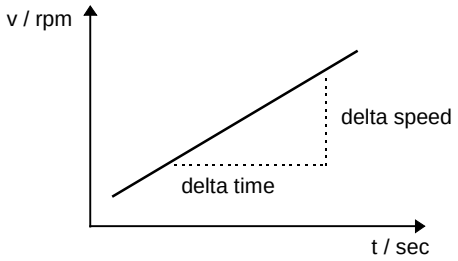
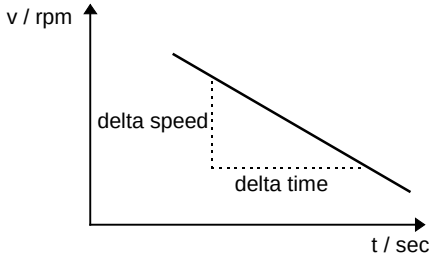
1414		Receive PDO 21 Communication Parameter			It contains the communication parameters of the manufacturer specific PDO21 the device is able to receive.
	00	Number of Entries	0x02 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x400+NodeID 0x00000401 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 ro	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)
1415		Receive PDO 22 Communication Parameter			It contains the communication parameters of the manufacturer specific PDO22 the device is able to receive.
	00	Number of Entries	0x02 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x500+NodeID 0x00000501 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 ro	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)
Receive PDO Mapping Parameters					
1600		Receive PDO 1 Mapping Parameter			It contains the mapping parameters of the first PDO the device is able to receive. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length.
	00	Number of Entries	0x01 0x00 0x40	u8 ro	
	01	PDO Mapping Entry	0x60400010 0x00000000 0xFFFFFFFF	u32 ro	
1605		Receive PDO 6 Mapping Parameter			It contains the mapping parameters of the PDO6 the device is able to receive. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length.
	00	Number of Entries	0x02 0x0 0x40	u8 ro	
	01	PDO Mapping Entry	0x60400010 0x00000000 0xFFFFFFFF	u32 ro	
	02	PDO Mapping Entry	0x60420010 0x00000000 0xFFFFFFFF	u32 ro	
1614		Receive PDO 21 Mapping Parameter			It contains the mapping parameters of the PDO6 the device is able to receive. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length.
	00	Number of Entries	0x04 0x00 0x40	u8 ro	
	01	PDO Mapping Entry	0x27D10010 0x00000000 0xFFFFFFFF	u32 ro	
	02	PDO Mapping Entry	0x27D30010 0x00000000 0xFFFFFFFF	u32 ro	
	03	PDO Mapping Entry	0x27D40010 0x00000000 0xFFFFFFFF	u32 ro	
	04	PDO Mapping Entry	0x27D50010 0x00000000 0xFFFFFFFF	u32 ro	
1615		Receive PDO 22 Mapping Parameter			It contains the mapping parameters of the PDO6 the device is able to receive. Sub-index 0 contains the number of the mapped data

					objects. All further entries define the data by it's index, sub-index and length.
	00	Number of Entries	0x04 0x00 0x40	u8 ro	
	01	PDO Mapping Entry	0x27D60010 0x00000000 0xFFFFFFFF	u32 ro	
	02	PDO Mapping Entry	0x27D70010 0x00000000 0xFFFFFFFF	u32 ro	
	03	PDO Mapping Entry	0x27D80010 0x00000000 0xFFFFFFFF	u32 ro	
	04	PDO Mapping Entry	0x27D90010 0x00000000 0xFFFFFFFF	u32 ro	
Transmit PDO Communication Parameters					
1800		Transmit PDO 1 Communication Parameter			It contains the communication parameters of the first PDO the device is able to transmit.
	00	Number of Entries	0x04 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x180+NodeID 0x00000181 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 ro	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)
	03	Inhibit Time	0x03E8 0x0000 0xFFFF	u16 rw	An inhibit time can be defined on sub-index 3 in 100 µs. This time is minimum interval for PD transmission. Default 100 ms
	04	Compatibility Entry	0x03 0x00 0xFF	u8 ro	
1805		Transmit PDO 6 Communication Parameter			It contains the communication parameters of the PDO 6 the device is able to transmit.
	00	Number of Entries	0x05 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x280+NodeID 0x00000281 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 rw	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)
	03	Inhibit Time	0x03E8 0x0000 0xFFFF	u16 rw	An inhibit time can be defined on sub-index 3 in 100 µs. This time is minimum interval for PD transmission. Default 100 ms
	04	Compatibility Entry	0x03 0x00 0xFF	u8 ro	
	05	Event Timer	0x0000 0x0000 0xFFFF	u16 rw	Event Time can be define on subindex 5 in 1ms resolution. This is the time interval PDO will be transmitted. Value 0 = Disable Event Timer
1814		Transmit PDO 21 Communication Parameter			It contains the communication parameters of the PDO 21 the device is able to transmit.
	00	Number of Entries	0x05 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x380+NodeID 0x00000381 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00	u8 rw	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (

			0xFF		=event driven)
	03	Inhibit Time	0x03E8 0x0000 0xFFFF	u16 rw	An inhibit time can be defined on sub-index 3 in 100 µs. This time is minimum interval for PD transmission. Default 100 ms
	04	Compatibility Entry	0x03 0x00 0xFF	u8 ro	
	05	Event Timer	0x0000 0x0000 0xFFFF	u16 rw	Event Time can be define on subindex 5 in 1ms resolution. This is the time interval PDO will be transmitted. Value 0 = Disable Event Timer
1815		Transmit PDO 22 Communication Parameter			It contains the communication parameters of the PDO 22 the device is able to transmit.
	00	Number of Entries	0x05 0x02 0x05	u8 ro	Sub-index 0 contains the number of PDO-parameters implemented.
	01	COB-ID	0x480 + NodeID 0x00000481 0xFFFFFFFF	u32 ro	Sub index 1 describes the COB-ID. If bit 31 is set the PDO is disabled.
	02	Transmission Type	0xFF 0x00 0xFF	u8 rw	The transmission mode is defined by sub-index 2. Value 0xFF (255) = asyncronous transmission mode (=event driven)
	03	Inhibit Time	0x03E8 0x0000 0xFFFF	u16 rw	An inhibit time can be defined on sub-index 3 in 100 µs. This time is minimum interval for PD transmission. Default 100 ms
	04	Compatibility Entry	0x03 0x00 0xFF	u8 ro	
	05	Event Timer	0x0000 0x0000 0xFFFF	u16 rw	Event Time can be define on subindex 5 in 1ms resolution. This is the time interval PDO will be transmitted. Value 0 = Disable Event Timer
Transmit PDO Mapping Parameters					
1A00		Transmit PDO 1 Mapping Parameter			It contains the mapping parameter for the PDOs the device is able to transmit. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length. The structure of a mapping entry is: index , subindex ,length
	00	Number of Entries	0x01 0x00 0x40	u8 ro	
	01	PDO Mapping Entry	0x60410010 0x00000000 0xFFFFFFFF	u32 ro	
1A05		Transmit PDO 6 Mapping Parameter			It contains the mapping parameter for the PDOs the device is able to transmit. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length. The structure of a mapping entry is: index, subindex, length
	00	Number of Entries	0x02 0x0 0x40	u8 ro	
	01	PDO Mapping Entry	0x60410010 0x00000000 0xFFFFFFFF	u32 ro	
	02	PDO Mapping Entry	0x60440010 0x00000000 0xFFFFFFFF	u32 ro	

1A14		Transmit PDO 21 Mapping Parameter			It contains the mapping parameter for the PDOs the device is able to transmit. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length. The structure of a mapping entry is: index, subindex, length
	00	Number of Entries	0x04 0x00 0x40	u8 ro	
	01	PDO Mapping Entry	0x28360010 0x00000000 0xFFFFFFFF	u32 ro	
	02	PDO Mapping Entry	0x28380010 0x00000000 0xFFFFFFFF	u32 ro	
	03	PDO Mapping Entry	0x28390010 0x00000000 0xFFFFFFFF	u32 ro	
	04	PDO Mapping Entry	0x283A0010 0x00000000 0xFFFFFFFF	u32 ro	
1A15		Transmit PDO 22 Mapping Parameter			It contains the mapping parameter for the PDOs the device is able to transmit. Sub-index 0 contains the number of the mapped data objects. All further entries define the data by it's index, sub-index and length. The structure of a mapping entry is: index,subindex,length
	00	Number of Entries	0x04 0x00 0x40	u8 ro	
	01	PDO Mapping Entry	0x283B0010 0x00000000 0xFFFFFFFF	u32 ro	
	02	PDO Mapping Entry	0x283C0010 0x00000000 0xFFFFFFFF	u32 ro	
	03	PDO Mapping Entry	0x283D0010 0x00000000 0xFFFFFFFF	u32 ro	
	04	PDO Mapping Entry	0x283E0010 0x00000000 0xFFFFFFFF	u32 ro	
Manufacturer Specific Parameters					
2000		AnyParameterReadID	0x0000 0x0000 0xFFFF	u16 rw	
2001		AnyParameterReadValue	0x00000000 0x00000000 0xFFFFFFFF	u32 ro	
2002		AnyParameterWrite	0x00000000 0x00000000 0xFFFFFFFF	u32 rw	
2003		NX current percentage	0x0000 0x0000 0xFFFF	u16 ro	Measured motor current. (1 = 0,01A)
2004		NX torque percentage	0x0000 0x0000 0xFFFF	u16 ro	Calculated torque. Scaled in 0,0%…100,0% (0…1000)
2063		NX fault code	0x0000 0x0000	i16 ro	Shows the drive fault code (=0, if no fault active)

			0xFFFF		
27D1		NX control word	0x0000 0x8000 0x7FFF	i16 rw	
27D3		NX speed reference	0x0000 0x8000 0x7FFF	i16 rw	
27D4		Process Data In1	0x0000 0x8000 0x7FFF	i16 rw	
27D5		Process Data In2	0x0000 0x8000 0x7FFF	i16 rw	
27D6		Process Data In3	0x0000 0x8000 0x7FFF	i16 rw	
27D7		Process Data In4	0x0000 0x8000 0x7FFF	i16 rw	
27D8		Process Data In5	0x0000 0x8000 0x7FFF	i16 rw	
27D9		Process Data In6	0x0000 0x8000 0x7FFF	i16 rw	
2836		NX status word	0x0000 0x8000 0x7FFF	i16 ro	
2838		NX actual speed	0x0000 0x8000 0x7FFF	i16 ro	
2839		Process data out1	0x0000 0x8000 0x7FFF	i16 ro	
283A		Process data out2	0x0000 0x8000 0x7FFF	i16 ro	
283B		Process data out3	0x0000 0x8000 0x7FFF	i16 ro	
283C		Process data out4	0x0000 0x8000 0x7FFF	i16 ro	
283D		Process data out5	0x0000 0x8000 0x7FFF	i16 ro	
283E		Process data out6	0x0000 0x8000 0x7FFF	i16 ro	
Device Profile Parameters					
6040		controlword	0x0000 0x0000 0xFFFF	u16 rw	The control command for the state machine. The state machine descripes the device status and possible control sequence of the drive.
6041		statusword	0x0000 0x0000 0xFFFF	u16 ro	The statusword indicates the current status of the drive.
6042		vl target velocity	0x0000 0x8000 0x7FFF	i16 rw	Speed reference of the drive. Unit: RPM
6043		vl velocity demand	0x0000 0x8000 0x7FFF	i16 ro	Speed reference after ramp function. Unit: RPM
6044		vl control effort	0x0000 0x8000 0x7FFF	i16 ro	Actual speed of the motor. Unit: RPM

6046		vl velocity min max amount			Defines speed limits of the drive in rpm. The parameter consist of a minimum and a maximum speed.
	00	Number of Entries	0x02 0x00 0x02	u8 ro	
	01	Minimum Speed	0x00000000 0x00000000 0xFFFFFFFF	u32 rw	
	02	Maximum Speed	0x00000000 0x00000000 0xFFFFFFFF	u32 rw	
6048		vl velocity acceleration			This parameter specifies the slope of the acceleration ramp. The parameter consist of two parts: the delta speed and the delta time. 
	00	Number of Entries	0x02 0x00 0x02	u8 ro	
	01	delta_speed	0x00000000 0x00000000 0xFFFFFFFF	u32 rw	
	02	delta_time	0x0001 0x0000 0xFFFF	u16 rw	
6049		vl velocity deceleration			This parameter specifies the slope of the deceleration ramp. The parameter consist of two parts: the delta speed and the delta time. 
	00	Number of Entries	0x02 0x00 0x02	u8 ro	
	01	delta_speed	0x00000000 0x00000000 0xFFFFFFFF	u32 rw	
	02	delta_time	0x0001 0x0000 0xFFFF	u16 rw	
604A		vl velocity quick stop			Not Used
	00	Number of Entries	0x02 0x00 0x02	u8 ro	
	01	delta_speed	0x00000000 0x00000000 0xFFFFFFFF	u32 rw	
	02	delta_time	0x0001 0x0000 0xFFFF	u16 rw	

6060		modes of operation	0x02 0x7F	0x80	i8 ro	This parameter switches the actually choosen operation mode.
6061		modes of operation display	0x02 0x7F	0x80	i8 ro	This parameter shows current mode of operation.

9. NODE GUARDING PROTOCOL

This protocol is used to detect remote errors in the network. Master can update status of slaves and slaves can guard is master active.
Each NMT slave uses one remote COB for node guarding protocol. The NMT Master polls each NMT slaves at regular time interval. This time interval is called guard time and may be different for each NMT slave. The response of the NMT slave contains the state of that NMT slave. Slave start guarding after one Node Guarding message was received from MNT master. After that if slave (=drive) don't receive any Node Guarding messages during "life time" it will generate "Fieldbus Fault".

Vacon CanOpen option board has following items for guarding purposes:

Index (HEX)	Sub-Index	Name	Default Min Max	Type Attr.	Descriptions
100C	00	Guard Time	1000 0 65535	u16 rw	This entry contains the guard time in milli-seconds. It is 0, if not used. Unit: ms
100D	00	Life Time Factor	2 0 255	u8 rw	The life time factor multiplied with the guard time gives the life time for the device. It is 0, if not used.

Default "life time" is 1000ms (Guard Time) * 2 (Life Time Factor) = 2 s

Example node quarding messages:

MASTER -> SLAVE (node id = 1)

Message	ID	Len	RTR
NMT (Node Guarding)	0x701	0	1

SLAVE RESPONSE (node id = 1)

Message	ID	Len	1
NMT (Node Guarding)	0x701	1	X

X = bit7 0 / 1 (Toggle bit)
bit6...0 Slave state (esim. 5 operational)

10. ELECTRONIC DATA SHEET, EDS-FILE

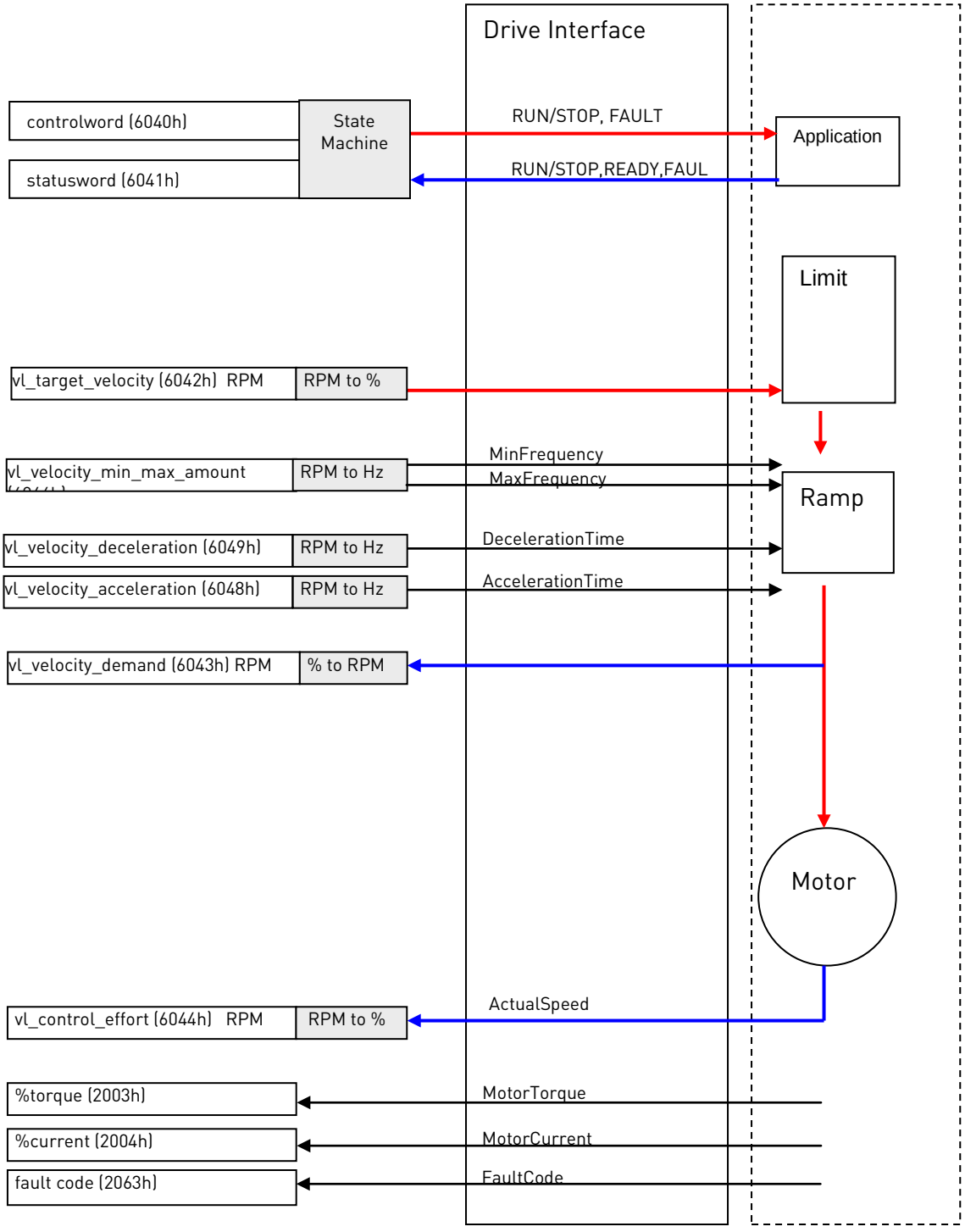
The usage of devices in a communication network requires configuration of the device parameters and communication facilities. CANopen defines a standardised way to access these parameters via the object dictionary.
For handling of the complexity of CANopen systems Software Tools are required. This reduces the complexity of the planning, configuration and analysis process and significantly increases the security of the system.
For this purpose Software Tools need an electronic description of the CANopen devices. To allow the usage of manufacturer independent Tools, this document defines a standardised file format – called Electronic Data Sheet EDS.
The EDS-file for Vacon CanOpen Option Board can be found from vacon web-site

11. APPENDICES

APPENDIX A - DEVICE PROFILE FOR DRIVES

Vacon CanOpen option board follows the Drive device profile DSP-402. The Velocity mode is supported.

Basic Device Control and Device Data Interface



APPENDIX B – SDO MESSAGES

Read Dictionary Object: SD01 Rx

Master to Slave (1)

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x601	0	4	Command	Object Index		Sub- Index	D0	D1	D2	D3

Command = 0x40

Command aaabbbbb (= 0100 0000)

aaa = 010, Initiate upload request

Response: SD01 Tx

Slave (1) to Master

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x581	0	8	***Reply***	***Object Index***		**Sub- Index**	D0	D1	D2	D3

Reply = e.g. 0x43

Reply aaabcces (= 0100 0011)

aaa	= 010	Initiate upload response
b	= 0	not used
cc	= 00	number of empty bytes (that case answer consist of 4 bytes)
e	= 1	expedited transfer
s	= 1	data set size is indicated

Data D0...D4

Write Dictionary Object: SD01 Rx

Master to Slave (1)

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x601	0	8	***Command***	***Object Index***		**Sub- Index**	D0	D1	D2	D3

Command = e.g. 0x2B

Command aaabcces (= 0010 1011)

aaa	= 010	Initiate download request
b	= 0	not used
cc	= 00	number of empty bytes (that case answer consist of 4 bytes)
e	= 1	expedited transfer
s	= 1	data set size is indicated

Data D0...D4

Response: SD01 Tx

Slave (1) to Master

Header			Data							
ID	RTR	Len	1	2	3	4	5	6	7	8
0x581	0	4	***Reply***	***Object Index***		**Sub- Index**	D0	D1	D2	D3

Reply = 0x60

Reply aaabbbbb (= 0110 0000)

aaa	= 010	Initiate download response
bbbbb	= 0 0000	not used

APPENDIX C – PROCESS DATA CONTENTS

Process Data OUT (Slave → Master)

The fieldbus master can read the frequency converter's actual values using process data variables. *Basic, Standard, Local/Remote, Multi-Step, PID control and Pump and fan control* applications use process data as follows:

Data	Value	Unit	Scale
Process data OUT 1	Output Frequency	Hz	0,01 Hz
Process data OUT 2	Motor Speed	rpm	1 rpm
Process data OUT 3	Motor Current	A	0,1 A
Process data OUT 4	Motor Torque	%	0,1 %
Process data OUT 5	Motor Power	%	0,1 %
Process data OUT 6	Motor Voltage	V	0,1 V

The *Multipurpose* application has a selector parameter for every Process Data. The monitoring values and drive parameters can be selected using the ID number (see NX All in One Application Manual, Tables for monitoring values and parameters). Default selections are as in the table above.

Process Data IN (Master -> Slave)
ControlWord, Reference and Process Data are used with All-in One applications as follows:

Basic, Standard, Local/Remote, Multi-Step applications

Data	Value	Unit	Scale
Reference	Speed Reference	%	0.01%
ControlWord	Start/Stop Command Fault reset Command	-	-
PD1 – PD6	Not used	-	-

Multipurpose control application

Data	Value	Unit	Scale
Reference	Speed Reference	%	0.01%
ControlWord	Start/Stop Command Fault reset Command	-	-
Process Data IN1	Torque Reference	%	0.1%
Process Data IN2	Free Analog INPUT	%	0.01%
PD3 – PD6	Not Used	-	-

PID control and Pump and fan control applications

Data	Value	Unit	Scale
Reference	Speed Reference	%	0.01%
ControlWord	Start/Stop Command Fault reset Command	-	-
Process Data IN1	Reference for PID controller	%	0.01%
Process Data IN2	Actual Value 1 to PID controller	%	0.01%
Process Data IN3	Actual Value 2 to PID controller	%	0.01%
PD4–PD6	Not Used	-	-

APPENDIX D

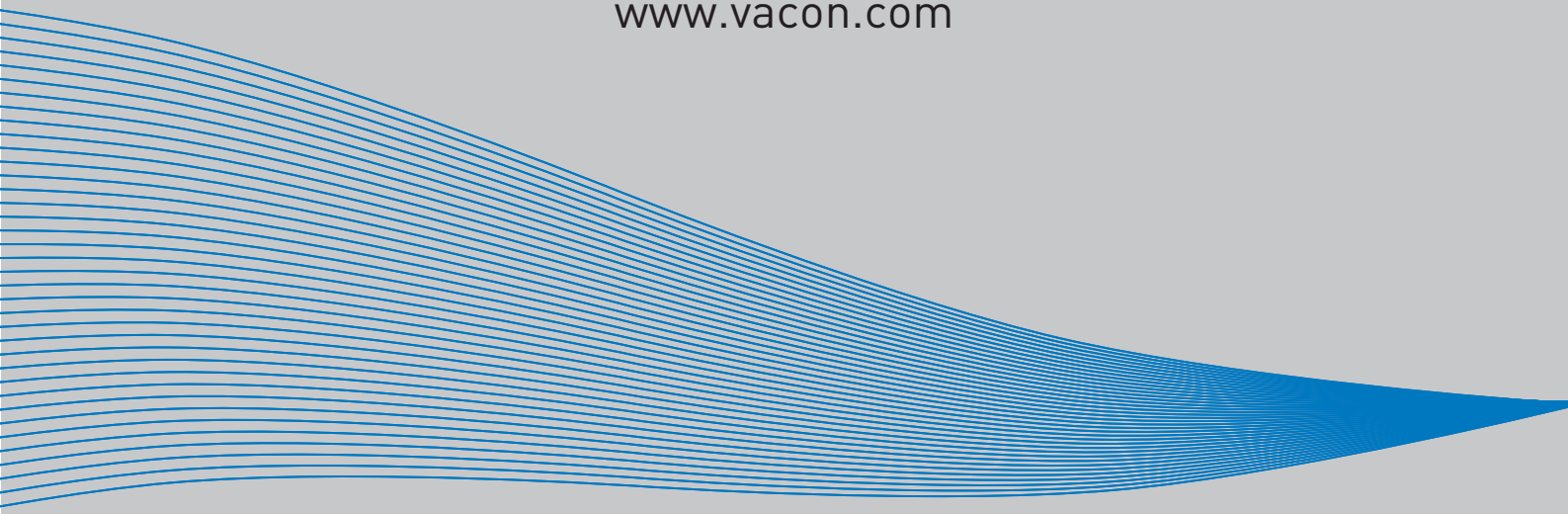
Version 8 of the C6 Option board doesn't work the same way than the others. Some changes are required at end of the PLC.

VACON

DRIVEN BY DRIVES

Find your nearest Vacon office
on the Internet at:

www.vacon.com



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