VACON® AC DRIVES

CANOPEN OPTION BOARD OPTE6 USER MANUAL



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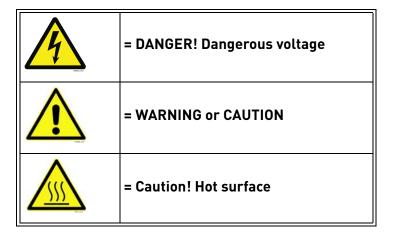
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1. SAFETY

This manual contains clearly marked cautions and warnings that are intended for your personal safety and to avoid any unintentional damage to the product or connected appliances.

Please read the information included in cautions and warnings carefully.

The cautions and warnings are marked as follows:



1.1 DANGER



The **components of the power unit are live** when the drive is connected to mains potential. Coming into contact with this voltage is **extremely dangerous** and may cause death or severe injury.



The motor terminals U, V, W and the brake resistor terminals are live when the AC drive is connected to mains, even if the motor is not running.



After disconnecting the AC drive from the mains, wait until the indicators on the keypad go out (if no keypad is attached, see the indicators on the cover). Wait 5 more minutes before doing any work on the connections of the drive. Do not open the cover before this time has expired. After expiration of this time, use a measuring equipment to absolutely ensure that no voltage is present. Always ensure absence of voltage before starting any electrical work!



The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when the AC drive is disconnected from mains.



Before connecting the AC drive to mains make sure that the front and cable covers of the drive are closed.



During a ramp stop (see the Application Manual), the motor is still generating voltage to the drive. Therefore, do not touch the components of the AC drive before the motor has completely stopped. Wait until the indicators on the keypad go out (if no keypad is attached, see the indicators on the cover). Wait additional 5 minutes before starting any work on the drive.

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1.2 WARNINGS



The AC drive is meant for fixed installations only.



Do not perform any measurements when the AC drive is connected to the mains.



The **earth leakage current** of the AC drives exceeds 3.5mA AC. According to standard EN61800-5-1, **a reinforced protective ground connection** must be ensured. See Chapter 1.3.



If the AC drive is used as a part of a machine, the **machine manufacturer is responsible** for providing the machine with a **supply disconnecting device** (EN 60204-1).



Only **spare parts** delivered by the manufacturer can be used.



At power-up, power break or fault reset **the motor will start immediately** if the start signal is active, unless the pulse control for Start/Stop logic has been selected. Furthermore, the I/O functionalities (including start inputs) may change if parameters, applications or software are changed. Disconnect, therefore, the motor if an unexpected start can cause danger.



The **motor starts automatically** after automatic fault reset if the auto restart function is activated. See the Application Manual for more detailed information.



Prior to measurements on the motor or the motor cable, disconnect the motor cable from the AC drive.



Do not touch the components on the circuit boards. Static voltage discharge may damage the components.



Check that the **EMC level** of the AC drive corresponds to the requirements of your supply network.



Wear protective gloves when you do mounting, cabling or maintenance operations. There can be sharp edges in the AC drive that can cause cuts.

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1.3 EARTHING AND EARTH FAULT PROTECTION



CAUTION!

The AC drive must always be earthed with an earthing conductor connected to the earthing terminal marked with (\downarrow) .

The earth leakage current of the drive exceeds 3.5mA AC. According to EN61800-5-1, one or more of the following conditions for the associated protective circuit must be satisfied:

- 0) The protective conductor must have a cross-sectional area of at least 10 mm^2 Cu or 16 mm^2 Al, through its total run.
- a) Where the protective conductor has a cross-sectional area of less than 10 mm^2 Cu or 16 mm^2 Al, a second protective conductor of at least the same cross-sectional area must be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm^2 Cu or 16 mm^2 Al.
- b) Automatic disconnection of the supply in case of loss of continuity of the protective conductor.

The cross-sectional area of every protective earthing conductor which does not form part of the supply cable or cable enclosure must, in any case, be not less than:

- 2.5mm² if mechanical protection is provided or
- 4mm² if mechanical protection is not provided.

The earth fault protection inside the AC drive protects only the drive itself against earth faults in the motor or the motor cable. It is not intended for personal safety.

Due to the high capacitive currents present in the AC drive, fault current protective switches may not function properly.



Do not perform any voltage withstand tests on any part of the AC drive. There is a certain procedure according to which the tests must be performed. Ignoring this procedure can cause damage to the product.

NOTE! You can download the English and French product manuals with applicable safety, warning and caution information from

http://drives.danfoss.com/knowledge-center/technical-documentation/.

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 http://drives.danfoss.com/knowledge-center/technical-documentation/

2. CANOPEN OPTION BOARD OPTES - GENERAL

2.1 OVERVIEW

OPTE6 is a CANopen adapter board for $VACON^{\otimes}$ AC drives. The board allows the AC drive to be controlled by using the CANopen protocol. The board implements the AC drive profile with the velocity mode.

The option board firmware implements the following protocol specifications:

- CiA-301 CANopen communication specification version 4.2
- CiA-402 CANopen Profile for Drives and Motion Controller version 3.2

Device: AC drive

Operation mode: velocity mode

• **CiA-303-3** CANopen indicator specification, implemented by using 2 CANopen status led indicators

2.2 SOFTWARE

2.2.1 CAN

The CAN data link layer protocol is standardised in ISO 11898. The standard describes mainly the data link layer composed of the logical link control (LLC) sub layer and the media access control (MAC) sub layer, and some aspects of the physical layer of the OSI reference model.

2.2.2 CANOPEN

CANopen is an application layer protocol on top of the CAN bus.

The protocol specification describes:

- Set of bit rates to support
- Network Management (NMT)
- Service data transmission (SD0)
- Process data transmission (PD0)
- Error message transmission (EMCY)
- Node status monitoring (heartbeat and node guarding)
- Identity information
- Parameter saving and restoring

3. CANOPEN PROTOCOL DESCRIPTION

3.1 NMT

NMT network management manages CANopen, and is a mandatory, common feature for all devices. The protocol describes several node control services and the state machine.

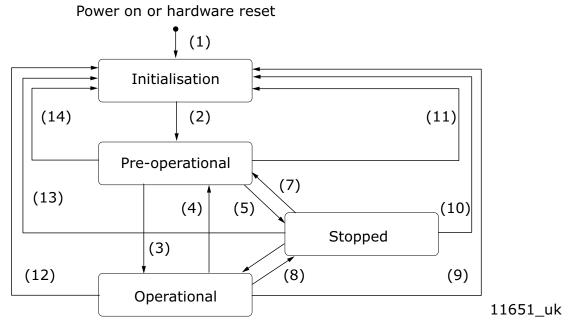


Figure 1. NMT state machine

- 1 = When the power is on, the NMT state is entered autonomously
- 2= The NMT state initialisation is finished, the NMT pre-operational state is entered automatically
- 3 = NMT service starts with remote node indication or by local control
- 4 and 7 = NMT service enters pre-operational indication
- 5 and 8 = NMT service stops remote node indication
- 6 = NMT service starts remote node indication
- 9, 10 and 11 = NMT resets node indication
- 12, 13 and 14 = Indication of NMT service reset communication

Boot-up protocol

After a node starts, it will enter automatically into the pre-operational state. Always when this transition occurs, a boot-up message is sent into the bus.

Table 1: Boot-up message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x700 + Node ID	1	0							

3.2 Node control protocols

Protocol start remote node

The start remote node message sets the node(s) into operational state. See Figure 1. NMT state machine. If the node ID in the message is set to '0', the message affects all nodes (broadcast).

Table 2: Start remote node message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x0	0x2	0x1	NODE ID						

Protocol stop remote node

The stop remote node message sets the node(s) into stopped state. See Figure 1 NMT state machine. If the node ID in the message is set to '0', the message affects all nodes (broadcast). When the node is in stopped state, it will not answer to SDO or PDO messages.

Table 3: Stop remote node message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x0	0x2	0x2	NODE ID						

Protocol enter pre-operational

The enter pre-operational message sets the node(s) into pre-operational state. See Figure 1. NMT state machine. If the node ID in the message is set to '0', the message affects all nodes (broadcast). When the node is in pre-operational state, it will not answer to PDO messages.

Table 4: Enter pre-operational message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x0	0x2	0x80	NODE ID						

Protocol reset node

The reset node message makes the node(s) apply application reset. See Figure 1. NMT state machine. Application reset sets the whole object dictionary back to the default or previously saved values. If the node ID in the message is set to '0', the message affects all nodes (broadcast). After the node has made the application reset, it will enter the pre-operational state automatically from the initialising state. This also creates a boot-up event and the boot-up message is sent after the reset.

Table 5: Reset node message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x0	0x2	0x81	NODE ID						

Protocol reset communication

The reset communication message makes the node(s) apply communication reset. See Figure 1. NMT state machine. Communication reset does not affect the object dictionary values. If the node ID in the message is set to '0', the message affects all nodes (broadcast). After the node has made the communication reset, it will enter the pre-operational state automatically from the initialising state. This also creates a boot-up event and the boot-up message is sent after the reset.

Table 6: Reset communication message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x0	0x2	0x82	NODE ID						

3.3 ERROR CONTROL PROTOCOLS

It is not allowed to use guarding protocol and heartbeat protocol on one NMT slave at the same time. If the heartbeat producer time is unequal 0, the heartbeat protocol is used.

3.3.1 HEARTBEAT PROTOCOL

Heartbeat protocol defines the producer and consumer. The producer node sends its NMT status that is then available for any consumer node. The consumer node is the receiver of heartbeat messages. The producer node has a timing parameter that indicates how often the heartbeat message should be sent. The consumer node has a relative parameter that indicates how often the heartbeat message should be received. If the consumer does not receive the heartbeat message within the time defined in the heartbeat object entry, an error event occurs.

Table 7: Node status description

Value	Description
0x0	Boot-up
0x4	Stopped
0x5	Operational
0x7F	Pre-operational

Table 8: Heartbeat message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x700 + Node ID	0x1	Status							

Table 9: Heartbeat-related objects in OD

Index Description			
0x1016	Consumer heartbeat time		
0x1017	Producer heartbeat time		
0x1029	Error behaviour		

3.3.2 NODE GUARDING PROTOCOL

Node guarding protocol is a NMT master driver protocol, where the master sends a remote transmission request, which is answered by the slave. The slave response includes one data byte that consists of a NMT slave state, and a toggle bit that toggles every response.

NOTE! The CiA application note 802 recommends that the node guarding protocol should not be used, because of different handling of RTR frames in CAN controllers.

OPTE6 option board does not have a hardware-triggered automatic response to the RTR frame. RTR information is handled by software, and the response data always consists of updated information.

Table 10: Node guarding RTR frame (remote request)

CAN ID	LENGTH	RTR	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x700 + Node ID	0x0	1								

Table 11: Node guarding response

CAN ID	LENGTH	DAT	ΓΑ0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x700 + Node ID	0x1	t	Status							

Table 12: Node guarding slave status

Status		
Value	Description	
0x4	Stopped	
0x5	Operational	
0x7F	Pre-operational	

Table 13: Node guarding related objects in OD

Index	Description
0x100C	Guard time
0x100D	Life time factor

3.3.3 EMCY OBJECT

Option board works as an EMCY producer. The EMCY object is transmitted when a fault occurs in the drive or option board. To switch off the EMCY producer, disable the EMCY COB-id by writing MSB to 1 (object 0x1014).

When an error occurs, the EMCY message is transmitted with the current value of the error register and the error code is inserted into the pre-defined error field list. The newest error code is

always the first sub-index on the error field list. When all active errors are cleared, an empty EMCY object is transmitted.

If a drive-internal fault occurs, the MSEF field contains the drive fault code. See the application and user manual for possible fault codes. The ER field holds a bit coded value of the error type. See object 0x1001 for more details.

Table 14: EMCY message

CAN ID	LENGTH	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
0x80 + Node ID	0x8	EEC		ER			MSEF		

Table 15: EMCY message data fields

EEC	Emergency error code
ER	Error register value
MSEF	Manufacturer-specific error code

Table 16: Used EMCY error codes and description MSEF fields

DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7		
0x0	0000		3: Number of remaining error sources						
0x1	000			Dr	ive fault cod	des			
0x8	3110				-				
0x8	3120	1	-						
0x0	0x8130		3: Heartbeat consumer subindex 4: Heartbeat consumer node-ID						
0x8	3140		-						
0x8	3210				-				
0x8	0x8220 0x8240		-						
0x8			-						
0x8	3250				-				

Table 17: Description and behavior of different error situations

EEC	Description	Error behaviour	Err LED
0x0000	Error Reset or No Error	If MSEF field is empty all error sources are cleared and drive fault is cleared.	-
0x1000	Generic Error	Drive fault codes have changed.	-
0x8120	CAN in Error Passive Mode	EMCY is sent after CAN driver goes back to active state. This also clears the fault.	Single flash
	Life Guard Error	Error is reset when a RTR is received or either of the life guard objects (0x100C, 0x100D) is written to zero.	Double
0x8130	Heartbeat Error	Error is reset when a HB message is received by the HB consumer, or the consumer entry is changed (either Node-ID or Heartbeat Time).	flash

Table 17: Description and behavior of different error situations

0x8140	Recovered from Bus-Off	EMCY is sent after CAN driver goes back to active state. This also clears the fault.	On
0x8250	PD0 timer expired	Error is cleared when a PDO is received (in expired PDO).	Quadruple flash

All communication errors are reset if a reset command is given. This does not however reset drive faults if there are active error sources.

EMCYs are also created in some cases, even though a fault is not created. These are for notification only.

Table 18: Notification EMCY objects

EEC	Description
0x8110	CAN overrun (objects lost)
0x8210	PDO not processed due to length error
0x8220	PDO length exceeded
0x8240	Unexpected SYNC data length

Table 19: EMCY-relate objects in OD

Index	Description
0x1001	Error register
0x1003	Pre-defined error field list
0x1014	EMCY object COB-ID

3.4 SDO PROTOCOL

The Option board contains one SDO server. The SDO protocol provides a direct access to the object entries of the object dictionary of the CANopen device. Each message is acknowledged by the server. The protocol is mostly used to set and read parameters from the object dictionary at the pre-operational state. Some objects have limitations for SDO usage at the operational state.

Up to four bytes can be transferred by using the expedited transfer, where the data fits into one CAN message. For bigger than 4-byte object sizes, segmented transfer must be used. Optionally, block transfer is also possible with bigger data types. Block transfer is most efficient with big data sizes.

Table 20: SDO-related objects in OD

Index	Description
0x1200	SDO server parameter object

3.5 PDO PROTOCOL

Process data objects PDOs are used to transmit real-time data with no protocol overhead. Each PDO has its mapping and communication parameter record.

There are two different types of PDOs. Transmit PDOs for producing data into network and Receive PDOs for consuming data from network. OPTE6 board supports 3 receive and 3 transmit PDOs.

Table 21: PDO-related objects in OD

Index	Description
0x1400	1st rxPD0 communication parameter record
0x1401	2nd rxPDO communication parameter record
0x1402	3rd rxPDO communication parameter record
0x1600	1st rxPDO mapping parameter record
0x1601	2nd rxPDO mapping parameter record
0x1602	3rd rxPDO mapping parameter record
0x1800	1st txPD0 communication parameter record
0x1801	2nd txPD0 communication parameter record
0x1802	3rd txPD0 communication parameter record
0x1A00	1st txPDO mapping parameter record
0x1A01	2nd txPD0 mapping parameter record
0x1A02	3rd txPDO mapping parameter record

3.5.1 PDO COMMUNICATION PARAMETER RECORD

PDO communication parameter record defines the COB-id, transmission type and how often the PDO is transmitted. The fields can be modified during the pre-operational state.

Table 22: PDO communication parameter record

Indexes	Sub-index	Name	Data type	RX PDO	TX PDO
	0	Highest sub-index supported	UNSIGNED8	ro	ro
0.4/00	1	COB ID	UNSIGNED32	r/w	r/w
0x1400 0x1401	2	Transmission type	UNSIGNED8	r/w	r/w
0x1402 0x1800	3	Inhibit time	UNSIGNED16	ro	r/w
0x1801 0x1802	4	Reserved	UNSIGNED8	ro	ro
021002	5	Event timer	UNSIGNED16	r/w	r/w
	6	SYNC start value	UNSIGNED8	Not available	r/w

3.5.2 COB ID

COB ID determines whether the PDO is valid (active) and using 11-bit or 29-bit frames.

Table 23: COB ID

31	30	29	28 11	10 0
Valid	Reserved	Гио ио о	0x00000	11-bit CAN-ID
Vallu	Reserveu	Frame	29-bit	CAN-ID

Table 24: COB ID data fields

Bit(s)	Value	Description
	0	PDO exists / enabled
Valid	1	PDO does not exist / disabled
Reserved	х	Not applicable
Frame	0	11-bit CAN-ID valid
Frame	1	20-bit CAN-ID valid
29-bit CAN-ID	х	29-bit CAN-ID of the CAN extended frame
11-bit CAN-ID	х	11-bit CAN-ID of the CAN base frame

3.5.3 TRANSMISSION TYPE

Table 25: PDO transmission types

Value	Description	Receive PD0	Transmit PD0
0x00	Synchronous (acyclic)	Х	Х
0x01	Synchronous (cyclic every sync)	X ₁	Х
0x02	Synchronous (cyclic every 2 _{nd} sync)	X ₁	Х
0x03	Synchronous (cyclic every 3rd sync)	X ₁	Х
0x04	Synchronous (cyclic every 4th sync)	X ₁	Х
		X ₁	Х
0xF0	Synchronous (cyclic every 240th sync)	X ₁	Х
0xF1	Reserved	-	-
		-	-
0xFB	Reserved	-	-
0xFC	RTR-only (synchronous)	-	Х
0xFD	RTR-only (Event-driven)	-	Х
0xFE	Event-driven (manufacturer-specific)	Х	Х
0xFF	Event-driven (device and application profile)	Х	Х

¹ For receive PDO, each sync transmission mode equals the same. Each sync always activates the latest received PDO value.

Synchronous means that the PDO is transmitted after the SYNC. The CANopen device starts sampling the data with the reception of the SYNC. If the transmission mode of the PDO is acyclic, the CANopen device gives an internal event, the sampling starts with the next SYNC and the PDO is transmitted afterwards. If the transmission mode is cyclic, the sampling starts with the reception of every SYNC, every second SYNC, every third SYNC etc. depending on the given value, and the PDO is transmitted afterwards.

RTR-only means that the PDO is requested via RTR. If the transmission mode of the PDO is synchronous, the CANopen device starts sampling with the reception of every SYNC and will buffer the PDO. If the mode is event-driven, the CANopen device starts the sampling with the reception of the RTR and transmits the PDO immediately.

Event-driven means that the PDO can be transmitted at any time based on the occurrence of the internal event of the CANopen device. An event that triggers the OPTE6 transmission occurs when the data mapped into the PDO is changed. Also, an event timer can be used to create transmit events.

Inhibit time

For transmit PDOs, the inhibit time defines the minimum transmission interval, when 0xFE or 0xFF transmission types are selected. For receive PDOs, the inhibit time is disabled. The inhibit time is 16bit unsigned value that is given as multiple of $100\mu s$. Zero value means that the inhibit time is disabled.

Event timer

For a transmit PDO event, the timer defines the maximum interval between the transmissions, if the transmission type is set to 0xFE or 0xFF.

For a receive PDO event, the timer activates the deadline monitoring. The deadline monitoring is activated at the first received PDO. If the time between the after the last PDO received is longer than defined in the event timer, a fault will occur.

Event timer is 16bit unsigned value that is given as multiple of 1ms. Zero value means that the event timer is disabled.

Sync start value

Sync start value gives the possibility to compensate network peak traffic in case of sync transmission mode. If the sync start value is zero, the normal sync behaviour for the PDO is used. If the sync start value is greater than zero, the PDO waits for the SYNC message that contains the counter value. When the counter value of a SYNC message equals the SYNC start value, the first SYNC message is regarded as received. The sync start value must not be changed while the PDO exists. See the SYNC message format in Table 29.

3.5.4 PDO PARAMETER MAPPING RECORD

Each PDO consists of a maximum of 8 bytes of mapped data. To data map the PDO, use a corresponding mapping record that consists of index, sub-index and the length of the mapped object.

Table 26: PDO mapping structure

31	16	15	8	7	0
Index		Sub-index		Length	

Table 27: PDO mapping parameter record

Indexes	Sub-index	Name	Data type	Access
0x1600	0	Number of mapped objects in PDO	UNSIGNED8	r/w
0x1601 0x1602	1	1st object to be mapped	UNSIGNED32	r/w
0x1A00	2	2nd object to be mapped	UNSIGNED32	r/w
0x1A01 0x1A02	3	3rd object to be mapped	UNSIGNED32	r/w
	4	4th object to be mapped	UNSIGNED32	r/w

To data map the PDOs, first disable the related PDO COB ID in the pre-operational state. In the mapping structure, write the sub-index 0 to zero (number of mapped objects). Then write the mapping structures on the mapping parameter record, starting from the sub-index 1. When you have written all the necessary structures, write the sub-index 0 to correspond to the mapped objects.

Example on how to write a dummy object to RPD01 4th entry (when using Bypass mode) is explained below:

 Transfer data (hex)
 Interpretation

 23 00 14 01 01 02 00 80
 Write RPD01 COB-ID (1400:01) to invalid (0x8000 0201)

 2F 00 16 00 00 00 00 00
 Write RPD01 mapping number of entries (1600:00) to 0

 23 00 16 04 10 00 06 00
 Write RPD01 4th entry (1600:04) to Dummy object (00060010)

 2F 00 16 00 04 00 00 00
 Write RPD01 mapping number of entries (1600:00) to 4

 23 00 14 01 01 02 00 00
 Write RPD01 COB-ID (1400:01) as valid (0x201)

Table 28. RPDO mapping example

3.6 SYNC PROTOCOL

Sync protocol is used by PDOs when the transmission is synchronous. The sync object that is defined by COB ID in the object 0x1005 triggers the transmission of the txPDOs, or activates the previously received data of the rxPDO. At the default sync message the CAN-ID is 0x80. The sync message is a zero-length message but optionally it can consist of an 8bit counter.

Table 29: SYNC message

CAN ID	LENGTH
0x80	0x0

Table 30: SYNC message with counter

CAN ID	LENGTH	DATA0
0x80	0x1	Counter

3.6.1 SYNC WITH COUNTER

When a counter is used in a sync message, the PDOs that have a defined sync start value compare the value against the sync message counter. The sync producer counter will overflow after it reaches the value defined in its 'synchronous counter overflow value' at the object 0x1019. Also, the sync consumer has the object 0x1019 even when the value itself is ignored. When the value of the sync consumer is greater than zero, the sync counter handling and expecting of the sync messages with counter are activated.

When the sync start value and the sync counter value match, the first sync message is regarded as received.

The following figure shows an example of SYNC messaging, when the slave is configured with:

- 0x1019 Synchronous counter 128
- 0x1800,2 Transmission type = 2 (Cyclic, No. of SYNCs = 2)
- 0x1800.6 Sync start value = 4

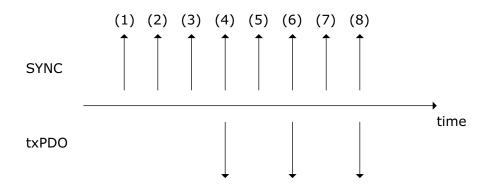


Figure 2. txPDO responses to SYNC messages

Table 31: Sync-related object in OD

Index	Description
0x1005	COB ID SYNC
0x1019	Synchronous counter
0x1014	EMCY object COB ID
0x1400	1st rxPD0 communication parameter record
0x1401	2nd rxPD0 communication parameter record
0x1402	3rd rxPDO communication parameter record
0x1800	1st txPDO mapping parameter record
0x1801	2nd txPDO mapping parameter record
0x1802	3rd txPDO mapping parameter record

3.7 COMMUNICATION OBJECTS

3.7.1 OX1000 - DEVICE TYPE

The device type object indicates basic information about the device, including the supported device profile and the profile settings.

Table 32: 0x1000 Device type

Index	Sub-index	Value	Name	Data type	Access
0x1000	-	0x00010192	Device type	UNSIGNED32	const

Value description:

0x0192 = 402 (Drive profile)

0x0001 = AC drive with PDO set for a generic drive device

3.7.2 OX1001 - ERROR REGISTER

Error register indicates the active error code.

Table 33: 0x1001 Error register

Index	Sub-index	Value	Name	Data type	Access
0x1001	-	0x0	Error register	UNSIGNED8	ro

Table 34: Error register bit descriptions

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*

^{*} Not used/supported

3.7.3 OX1003 - PRE-DEFINED ERROR FIELD

Pre-defined error field is a list of errors signaled with an EMCY object, listing the error history of up to 9 error entries. Sub-index 1 contains the latest error.

Table 35: 0x1003 Pre-defined error field

Index	Sub-index	Value	Name	Data type	Access
0x1003	0	0x0	Number of errors	UNSIGNED8	ro
	1	0x0	Standard error field	UNSIGNED32	ro
	9	0x0	Standard error field	UNSIGNED32	ro

3.7.4 OX1005 - COB ID SYNC

Defines the synchronisation message COB ID. Receiving the sync message causes actions in the PDOs that have a synchronous transmission mode.

Table 36: 0x1005 COB ID sync

Index	Sub-index	Value	Name	Data type	Access
0x1005	-	0x00000080	COB ID sync	UNSIGNED32	r/w

3.7.5 OX100C - GUARD TIME

The object contains the guard time in milliseconds. As a default, guarding is disabled.

Table 37: 0x100C Guard time

Index	Sub-index	Value	Name	Data type	Access
0x100C	-	0x0000	Guard time	UNSIGNED16	r/w

3.7.6 OX100D - LIFE TIME FACTOR

Life time factor is used together with guard time, which is multiplied with the life time factor.

Table 38: 0x100D Guard time

Index	Sub-index	Value	Name	Data type	Access
0x100D	-	0x00	Guard time	UNSIGNED8	r/w

Node life time = life time factor x guard time. If node life time is zero, guarding is disabled.

3.7.7 OX1014 - COB ID EMCY

The object defines the emergency message COB ID.

Table 39: 0x1014 COB ID EMCY

Index	Sub-index	Value	Name	Data type	Access
0x1014	-	0x00000080+ node id	COB ID EMCY	UNSIGNED32	r/w

Setting MSB (bit 31) to 1 will disable sending of EMCY messages.

3.7.8 OX1016 - HEARTBEAT CONSUMER ENTRIES

The device can act as the heartbeat consumer. Up to 8 devices can be monitored, as defined in the table below. If the heartbeat transmission delay of a defined node ID exceeds the heartbeat time, the error behaviour is activated according to the error behaviour object.

Table 40: 0x1016 Heartbeat consumer entries

Index	Sub-index	Value	Name	Data type	Access
	0	0x08	Number of entries	UNSIGNED8	ro
	1	0x0000 0000	Consumer heart beat time 1	UNSIGNED32	r/w
	2 3 0x1016 4 5 6	0x0000 0000	Consumer heart beat time 2	UNSIGNED32	r/w
		0x0000 0000	Consumer heart beat time 3	UNSIGNED32	r/w
0x1016		0x0000 0000	Consumer heart beat time 4	UNSIGNED32	r/w
		0x0000 0000	Consumer heart beat time 5	UNSIGNED32	r/w
		0x0000 0000	Consumer heart beat time 6	UNSIGNED32	r/w
	7	0x0000 0000	Consumer heart beat time 7	UNSIGNED32	r/w
	8	0x0000 0000	Consumer heart beat time 8	UNSIGNED32	r/w

Table 41: Consumer heartbeat time entry

31	24	23 16	15 (כ
Not used, must be zeroes.		Node ID	Heartbeat time	

3.7.9 OX1017 - PRODUCER HEARTBEAT TIME

Heartbeat producer object consists of the time in milliseconds (ms) that it takes to transmit the heartbeat message into the network. If the value is zero, the heartbeat is not used.

Table 42: 0x1017 Producer heartbeat time

Index	Sub-index	Value	Name	Data type	Access
0x1017	-	0x0000	Producer heartbeat time	UNSIGNED16	r/w

Table 43: Heartbeat message

CAN ID	LENGTH	DATA0
0x700 + node	0x1	Node state

3.7.10 OX1018 - IDENTIFY OBJECT

The object gives information about the option board

Table 44: 0x1018 Identify object

Index	Sub-index	Value	Name	Data type	Access
0	0	0x04	Number of entries	UNSIGNED8	ro
	1	0x90	Vendor ID	UNSIGNED32	ro
0x1018	2	-	Product code	UNSIGNED32	ro
	3	-	Revision number	UNSIGNED32	ro
	4	-	Serial number	UNSIGNED32	ro

3.7.11 OX1019 - SYNCHRONOUS COUNTER OVERFLOW VALUE

The synchronous counter overflow value defines whether a counter is mapped into the SYNC message, as well as the highest value the counter can reach. 0 disables the sync counter.

Table 45: 0x1019 Synchronous counter

Index	Sub-index	Value	Name	Data type	Access
0x1019	-	0x00	Synchronous counter	UNSIGNED8	r/w

3.7.12 OX1029 - ERROR BEHAVIOUR

Error behaviour allows a change in the default error behaviour if there is a communication error.

Table 46: 0x1029 Error behaviour

Index	Sub-index	Value	Name	Data type	Access	Min	Max
	0	0x01	Number of entries	UNSIGNED8	ro	2	2
0x1029	1	0x00	Communication error	UNSIGNED8	r/w	0	2
	2	0x01	Internal error	UNSIGNED8	r/w	1	1

Table 47: Error behaviour

Value	Description
0 Pre-operational	
1	No change in state
2	Stopped
3127	Reserved

3.8 SAVING AND RESTORING THE OBJECT DICTIONARY

CANopen defines a way of restoring the values in an object dictionary to the defaults and saving the values if the modified values must be valid after the power cycle. The manufacturer-specific bypass configuration can be restored to the object dictionary.

3.8.1 OX1010 STORE PARAMETER FIELD

To save the object dictionary, use the object 0x1010 'Store Parameter Field'.

The option board only saves the parameters in the object dictionary with a command. Autonomous saving is not supported. To save the parameters in the object dictionary, write the value 0x65766173 (ASCII "save") into the sub-index by using the SDO protocol.

Table 48: 0x1010 Store parameter field

Index	Sub-index	Name	Data type	Access
0x1010	0	Highest sub-index supported	UNSIGNED8	ro
	1	Save all parameters	UNSIGNED32	r/w

3.8.2 OX1011 RESTORE DEFAULT PARAMETERS

The object values of the object dictionary are restored to defaults by using the object 0x1011. Option board supports restoring All parameters (sub index 1) and manufacturer-specific Bypass mode defaults (sub index 4).

To restore parameters, write 0x64616F6C (ASCII "load") into the sub-index by using the SDO protocol. Default object values are selected after reset. Restore all default parameter restores CiA-402 default parameters (refer to Chapter 8.2.2.2). Bypass parameter set is described in Chapter 8.3.

Table 49: 0x1011 Restore default parameters

Index	Sub-index Name		Data type	Access
	0	Highest sub-index supported	UNSIGNED8	ro
	1	Restore all default parameters	UNSIGNED32	r/w
0x1011	4	Restore bypass parameter set*	UNSIGNED32	r/w
	5	Restore Puller parameter set	UNSIGNED32	r/w
	6	Restore Co-Extruder parameter set	UNSIGNED32	r/w

^{*} The bypassed set disables the CIA- 402 drive profile and resets the PDO mapping to the vendor specific configuration. See Chapter 8.2 and Chapter 8.3 for more information.

4. CANOPEN OPTION BOARD OPTE6 - TECHNICAL DATA

4.1 GENERAL

Table 50. Technical data of CANopen option board

CAN bus electrical isolation	500 VDC		
Ambient temperature	As specified in drive specification (-10°C 40°C)		
Storing temperature	As specified in drive spe	ecification (-40°C 70°C)	
Humidity	0-95%, non-condensing, corrosive		
Vibration and electrical safety	EN 61800-5-1 (2007) 5 15.8 Hz 1mm (peak) 15.8150 Hz 1 G		
Emission	C2 level, EN 61800-3 (2004)		
Immunity	C2 level, EN 61800-3 (2004)		
	Isolation	2500 V rms isolation with a less than 10-ns propagation delay	
CAN Interface	Protection	±8kV ESD IEC 61000-4-2 Contact Discharge ±80V Fault Protection greater than ±12V common Mode Range	

4.2 CAN CABLE

The recommended cables for installations are 4 wires twisted and a shielded cable with an impedance of 120 Ohm. The network topology is a 2-wire bus line that is terminated at both ends by resistors representing the characteristic impedance of the bus line. The typical CAN cable impedance is 120 Ohm, and so for the termination resistors of ~120 Ohm must be used. For long networks a higher resistor value must be used (150-300 Ohm).

Table 51. Bus parameter relation to cable length

Cable length	Max bit rate [kbit/s]	Max cable resistance $[m\Omega/m]$	
0-40 m	1000	Max 70	
100 m	500	<60	
500 m	100	<40	
1 km	50	<26	

4.2.1 ISOLATED GROUND CONNECTION

The OPTE6 option board is galvanically isolated. In CANopen networks that are completely galvanically isolated the CAN ground signal is carried in the cable line. It is connected at only one point into common ground potential. If one CAN device with not galvanically isolated interface is connected to the network, the potential for isolated CAN ground is given. Therefore only one device with not galvanically isolated interface may be connected to the network.

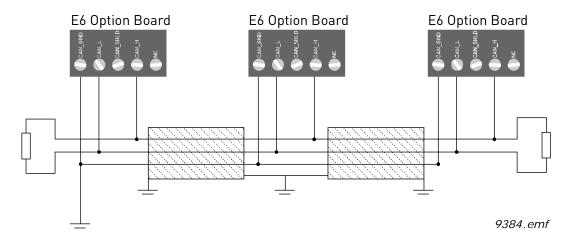
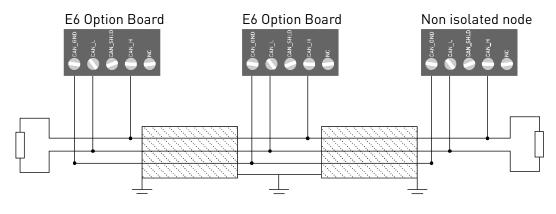


Figure 3. Completely isolated nodes



9385.emf

Figure 4. CAN network with one non-isolated node

4.2.2 RECOMMENDED CABLE

For all OPTE6 installations the use of 4-wire cable is recommended. 4 wires enable the connection of isolated digital grounds with nodes.

 $\mathsf{VACON}^{\circledR}$ recommends the following cable:

UNITRONIC® BUS CAN FD P

Colour-coded in accordance with DIN 47100



Figure 5. Recommended cable

Table 52. Cable thickness, length and baud rate relation

Bit rate		Min cable	thickness	
1 Mbit/s	0.25			
500 kbit/s	0.25	0.34		
250 kbit/s	0.25	0.34	0.6	
125 kbit/s	0.25	0.34	0.6	
100 kbit/s	0.25	0.34	0.6	0.6
50 kbit/s	0.25	0.34	0.6	0.6
Cable length	25	100	250	500

5. OPTE 6 LAYOUT AND CONNECTIONS

5.1 LAYOUT AND CONNECTIONS

OPTE6 has two different hardware revisions with slightly different layout. Layout is different in LED arrangement and termination resistor orientation.

The two hardware revisions are marked with different product codes, and this product code can be located from the sticker on the top side (location marked in Figure 6).

The two hardware revisions are named 70CVB01605 and 70CVB01124.

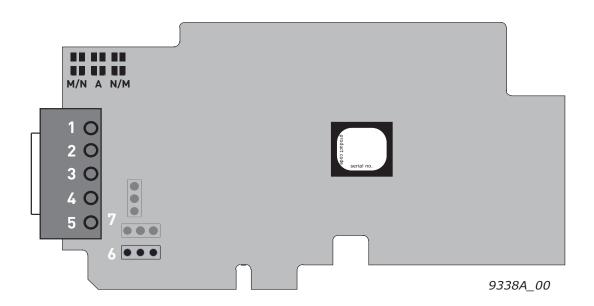


Figure 6. OPTE6 board layout

- 1 = CAN GND (isolated digital ground reference)
- 2 = CAN L
- 3 = SHIELD (shield connector)
- 4 = CAN H
- 5 = NC (No connection)
- 6 = Grounding option jumper
- 7= Bus termination resistor

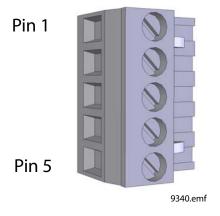


Figure 7. CAN connector

CAN connector pinout

1	CAN GND, isolated digital ground reference
2	CAN LO
3	Shield connector
4	CAN HI
5	No connection

5.2 LED INDICATIONS

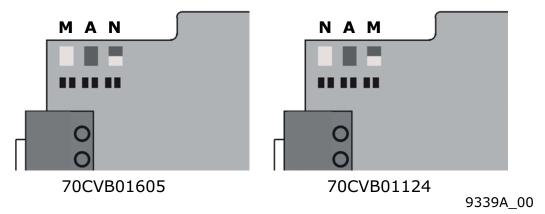


Figure 8. LED indicators

M = CANopen run led

A = CANopen err led

N = Board status

CANopen run led (green)

Blinking	The CANopen device is in the pre-operational state.
Single flash	The CANopen device is in the stopped state.
ON	The CANopen device is in the operational state.

CANopen err led (red)

0FF	No error
Blinking	Invalid configuration
Single flash	At least one of the error counters of the CAN controller has
Sillyte Itasii	reached or exceeded the warning level (too many error frames).
Double flash	A guard event (NMT slave or NMT master) or a heartbeat event
Double Itasii	(heartbeat consumer) has occurred.
Quadruple flash	An expected PDO was not received before the event timer
Quadi upie itasii	elapsed.
ON	The CAN controller is bus-off.

Board status led (green)

OFF	Option board is not activated.
ON	Option board is in initialization state, waiting activation command from the AC drive.
Blinking (once/ 1s)	Option board is activated and in RUN state. Option board is ready for external communication.

5.3 JUMPERS

The termination resistor jumper location differs on used hardware version. The jumper locations can be seen from figure below.

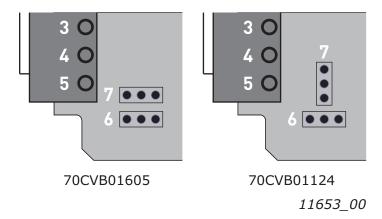


Figure 9. Jumper locations

The jumper (7) settings for the CAN bus termination resistor are shown in the figure below.

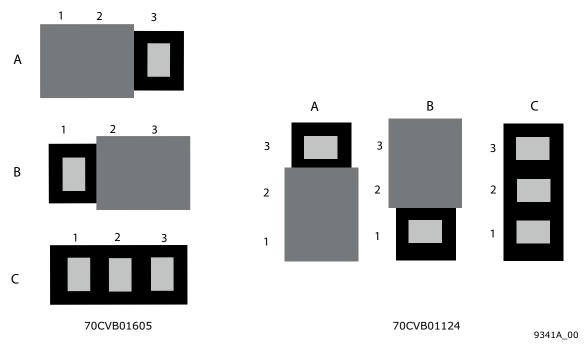


Figure 10. CAN bus termination jumper

- A = Termination resistor 120 Ohm connected
- B = Termination resistor is not connected to the CAN bus. (Factory default setting)
- C = Termination resistor is not connected to the CAN bus

The jumper (6) settings for the CAN cable shield grounding are shown in the figure below.

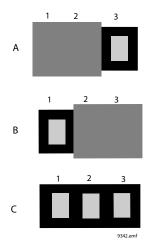


Figure 11. CAN shield grounding option

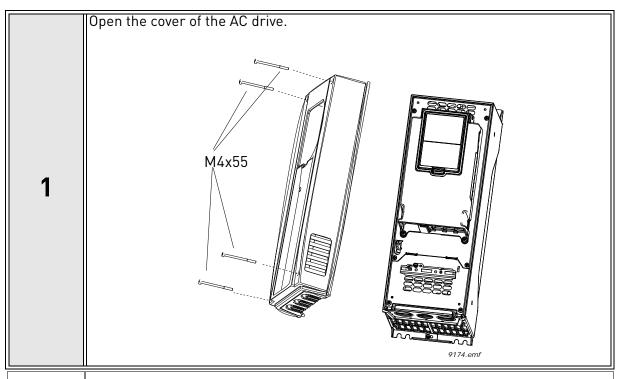
A = CAN connector pin 3 (shield) connected to the drive chassis with a high-impedance RC circuit. Recommended option when equipotential bonding is poor.

B = CAN connector pin 3 (shield) connected directly into the drive chassis. Recommended option when equipotential bonding is good. (Factory default setting)

C = CAN connector pin 3 is not connected.

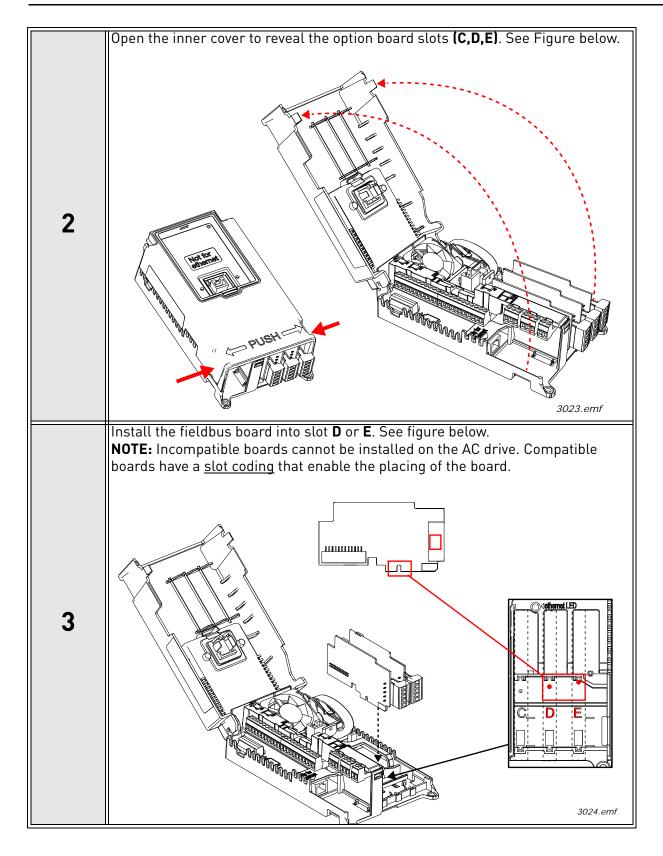
6. INSTALLATION

6.1 INSTALLATION IN VACON® 100





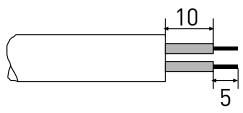
The relay outputs and other I/O-terminals may have a dangerous control voltage present even when AC drive is disconnected from mains.



6.2 PREPARE FOR USE THROUGH FIELDBUS

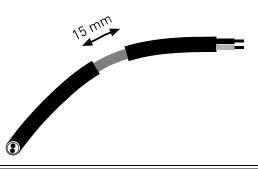
Strip about 15 mm of the fieldbus cable (see specification in ch. 3.2) and cut off the grey cable shield. Remember to do this for both bus cables (except for the last device).

Leave no more than 10 mm of the cable outside the terminal block and strip the cables at about 5 mm to fit in the terminals. See picture below.



4

Also strip the cable now at such a distance from the terminal that you can fix it to the frame with the grounding clamp. Strip the cable at a maximum length of 15 mm. **Do not strip the aluminum cable shield!**



5

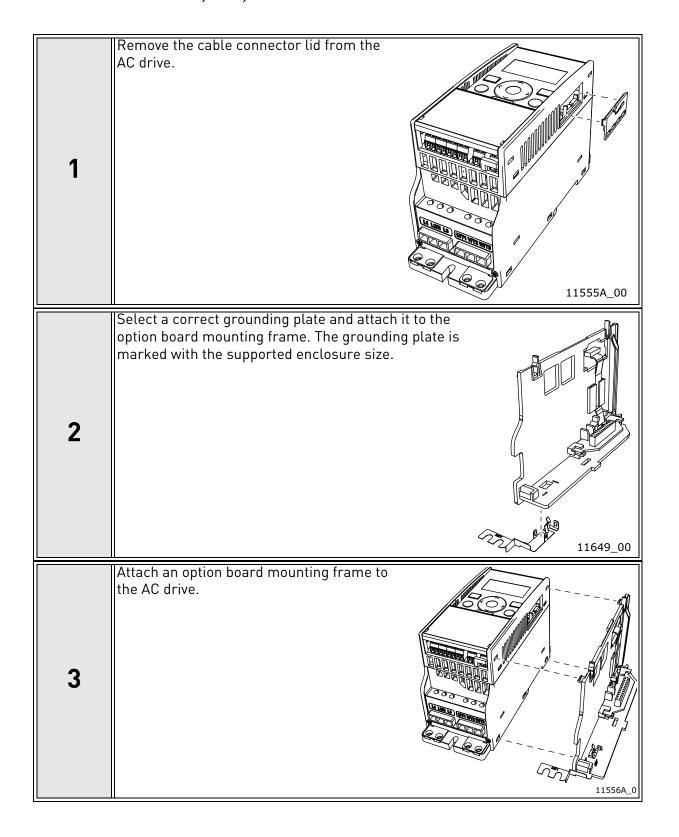
Then connect the cable to its appropriate terminals on the OPTE6 CANopen option board terminal block.

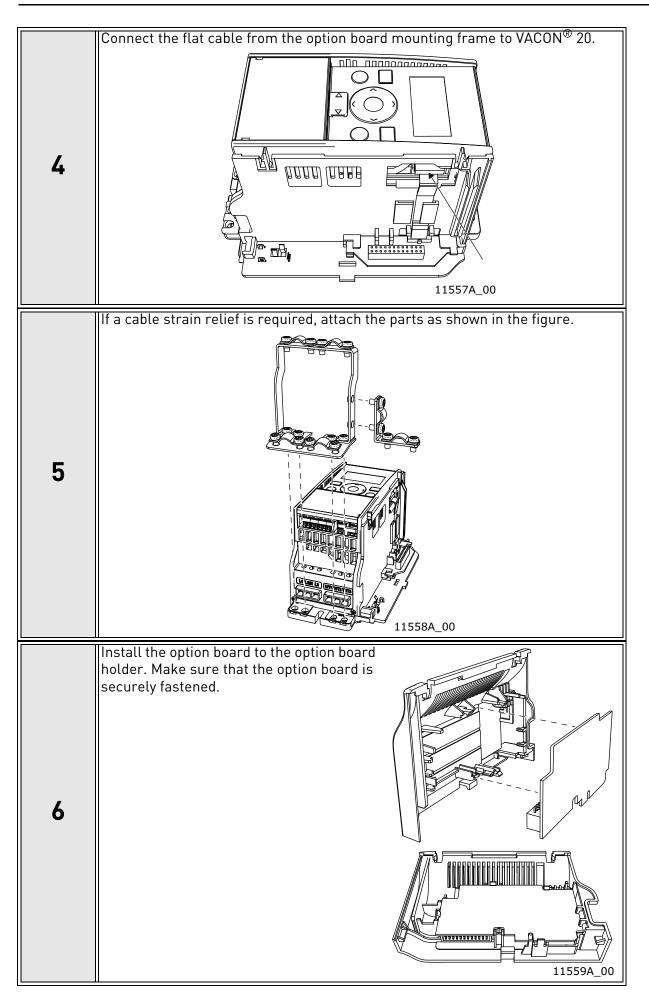
Using the cable clamp included in the delivery of the drive, ground the shield of the CAN cable to the frame of the AC drive. **NOTE:** This can be done in all drives if there is no difference in PE potential between the drives. However, if there is PE potential difference then the shield should be connected to PE only at one point in the system. The shields of the cables shall be joint but not connected to several PE points with different potential. 6 Cable clamp If the AC drive is the last device on the bus, the bus termination must be set 7 with jumper X13 (see ch. 4.3.) Unless already done for the other control cables, cut free the opening on the AC drive cover for the fieldbus cable (protection class IP21). NOTE: Cut the opening on the same side you have installed the board in! 8

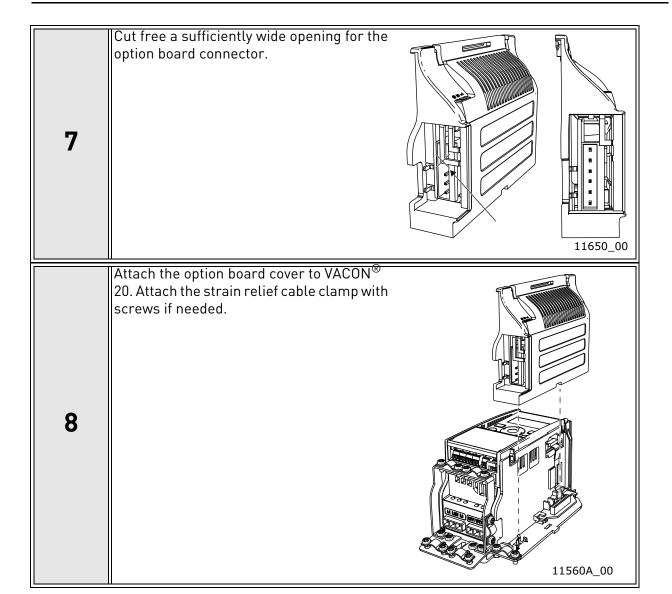
Remount the AC drive cover and run the cable as shown in picture. **NOTE:** When planning the cable runs, remember to keep the distance between the fieldbus cable and the motor cable at a minimum of 30 cm. It is recommended to route the option board cables away from the power cables as shown in the pic-9 Fieldbus cables The bus termination must be set for the first and the last device of the fieldbus line. See picture below. See also step 7 on page 38. We recommend that the first device on the bus and, thus, terminated was the Master device. Vacon 100 Vacon 100 Vacon 100 Vacon 100 Vacon 100 10 Termination activated Fieldbus cable Termination activated with Termination deactivated jumper ≡ Bus termination 3007.emf

6.3 INSTALLATION IN VACON® 20

6.3.1 FRAMES MI1, MI2, MI3



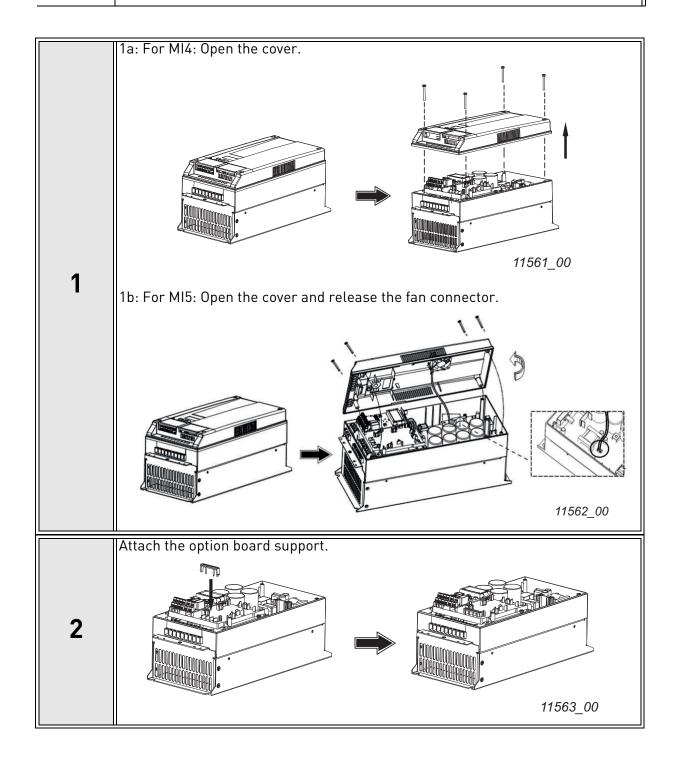


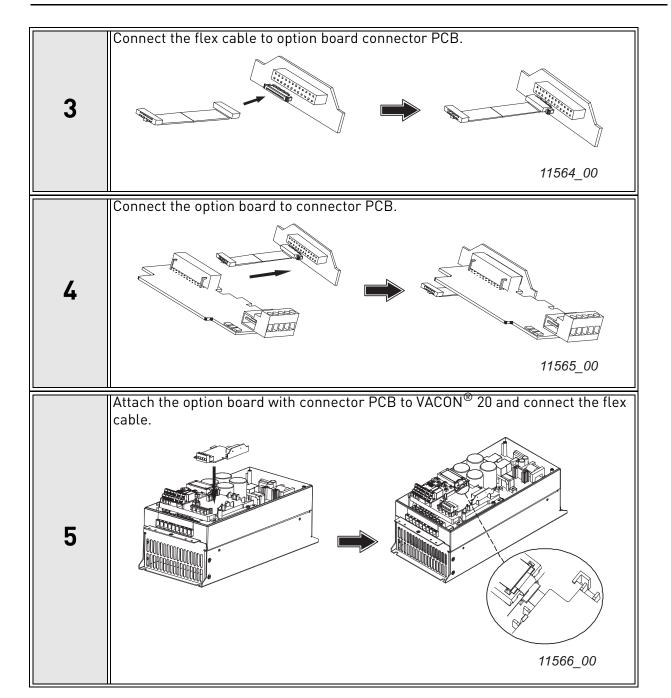


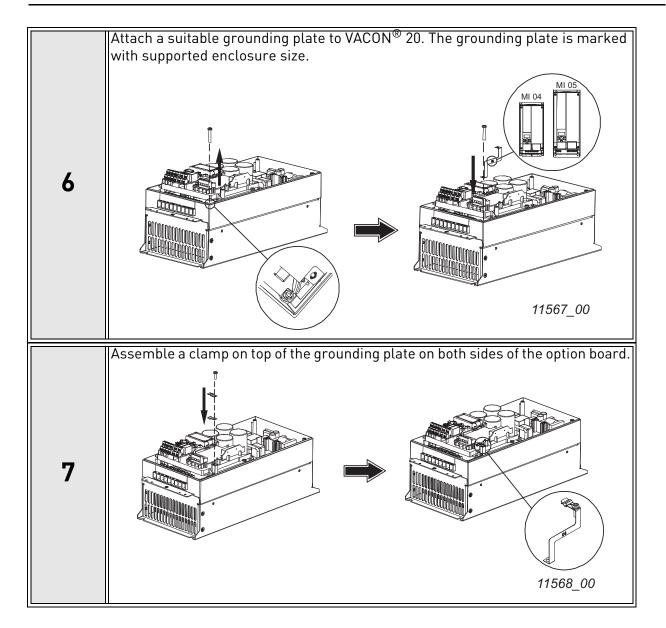
6.3.2 FRAMES MI4, MI5



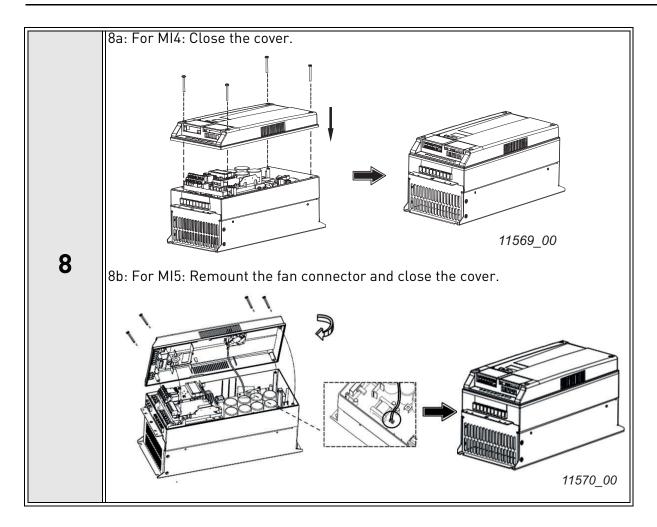
Make sure power is disconnected before opening the VACON $^{\circledR}$ 20 cover.







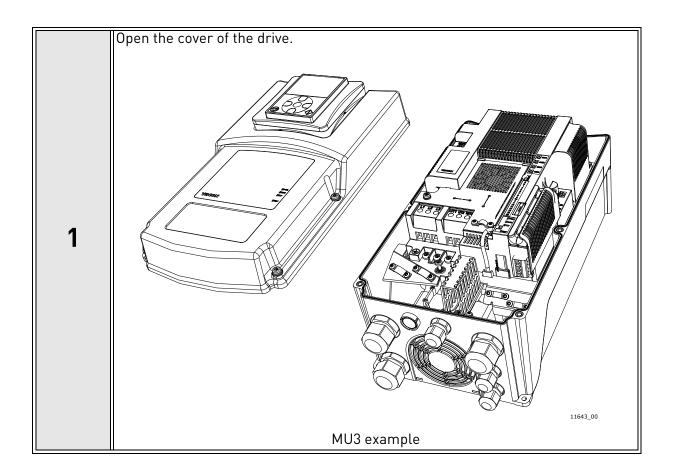
VACON ● 46 Installation



6.4 INSTALLATION IN VACON® 20 X AND 20 CP

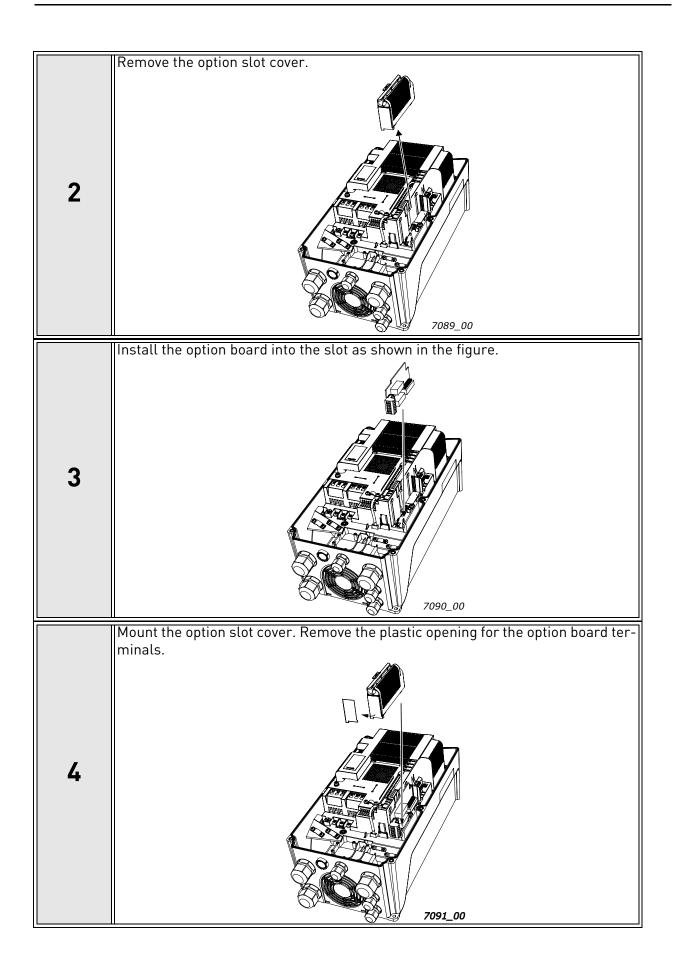


Do not add or replace option boards or fieldbus boards on an AC drive with the power switched on. This may damage the boards.

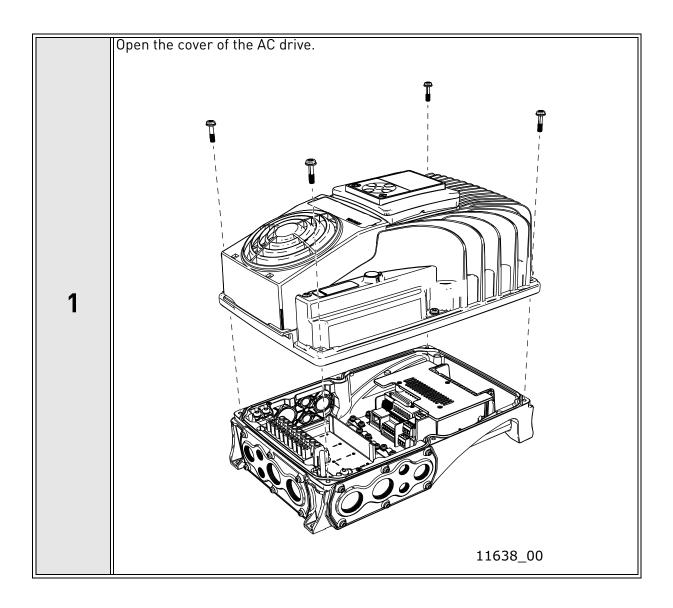


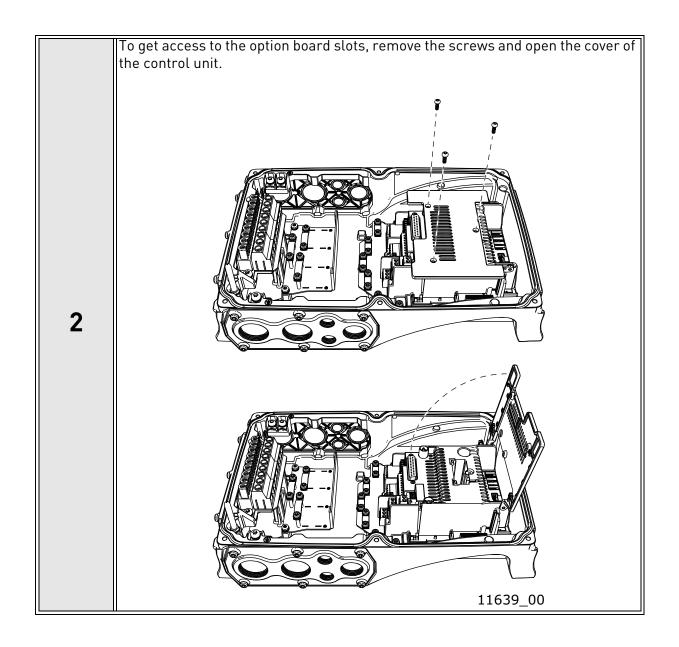


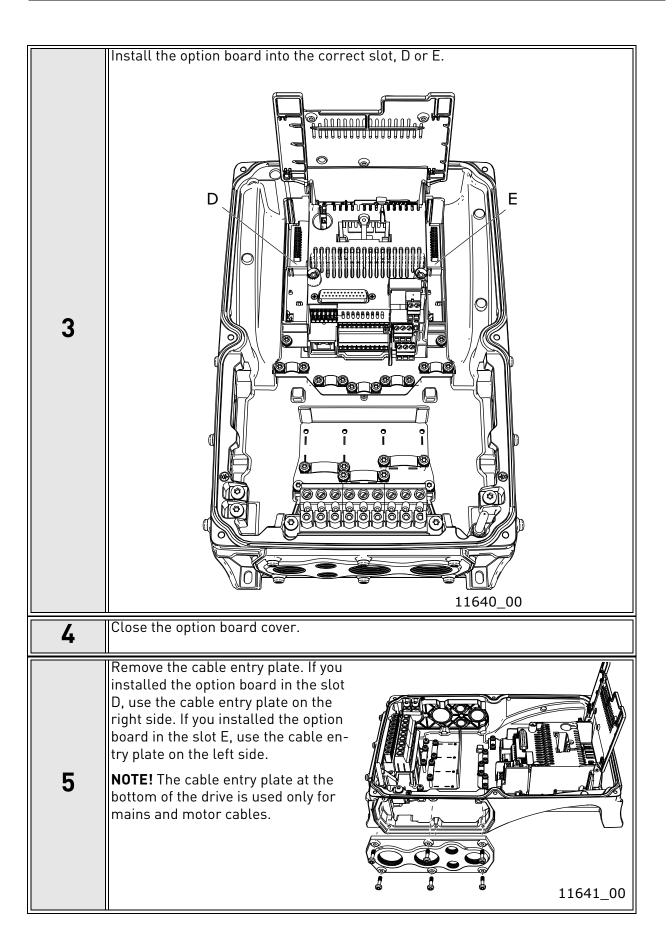
The relay outputs and other I/O-terminals may have a dangerous control voltage present even when the drive is disconnected from mains.



6.5 INSTALLATION IN VACON® 100 X (FRAMES MM4-MM6)







6	Open the necessary holes in the cable entry plate. Do not open the other holes. See the VACON® 100 X Installation Manual for the dimensions of the holes.
7	Attach a cable gland on the hole in the cable entry plate. Pull the fieldbus cable through the hole. NOTE! The fieldbus cable must go through the correct cable entry plate to avoid going near the motor cable.
8	Put the cable entry plate back.
9	Close the cover of the AC drive.

COMMISSIONING VACON ● 53

7. COMMISSIONING

This chapter describes how to commission the OPTE6 board for use. For instructions on how to setup the AC drive to be controlled over fieldbus, refer to Chapter 11 Appendix B - Fieldbus parametrization.

7.1 OPTE6 PANEL PARAMETERS

Different number of panel parameters are visible depending on the used AC drive and version. VACON $^{\textcircled{\$}}$ 20 family option board parameters are under SYS menu.

Panel code # **Parameter** Min Max Default **Description** VACON® 100 VACON® 20 family family Network-wide unique identifier 1 P5.x.3.1 P2.2 Node ID 1 127 for each CANopen device Data signalling rate. Should be **Baud Rate** 2 P5.x.3.2 P2.3 3 8 5 the same on each node in the same bus. See Table 54 Selection between OPTE6 operate 3 P2.4 Operate Mode 4 1 P5.x.3.3 1 modes. See Table 55 Timeout in seconds for CAN Comm. 5 P5.x.3.4* 0 65535 communication faults (PASSIVE. 1 Timeout BUS-OFF)

Table 53. OPTE6 board basic parameters

6

P5.x.3.5*

P5.x.3.6*

Value	Bit rate	
1	10 kbps (not supported)	
2	20 kbps (not supported)	
3	50 kbps	
4	100 kbps	
5	125 kbps	
6	250 kbps	
7	500 kbps	
8	1000 kbps	

Table 54. OPTE6 Baud Rate settings

N

0

1

1

0

0

Restore from

Set

Mode

Table 55. OPTE6 Operate Mode settings

Value	Name	Description
1	Drive Profile	CiA-402 drive profile, velocity mode active

0'1 All CANopen parameters are

reset to default values based on

Set OPTE6 mode. See Table 56

Operate Mode.

^{*} From version V26 (INDUSTRIAL) and V18 (FLOW)

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ValueNameDescription2BypassVACON® specific bypass mode active3Puller*CiA-420 EUROMAP profile, puller mode active4Co-Extruder*CiA-420 EUROMAP profile, co-extruder mode active

Table 55. OPTE6 Operate Mode settings

Baud Rate: used in CANopen communication. Regardless of the selected bitrate, the bit sample timing is set as close as possible to 87.5 % according to the CANopen specification.

Operate Mode: is used to change the modes of operation between standardized profile modes and VACON $^{\circledR}$ specific Bypass mode.

Different operate modes activate different device profile segment objects. Accessing e.g. CiA-402 velocity profile objects in Bypass mode is not possible. See Chapter 8.2 Velocity mode and Chapter 8.3 Bypass mode.

Comm. Timeout: Fieldbus communication timeout is time in seconds after a fault is created from CAN bus communication errors (PASSIVE, BUS-OFF). Setting this value to 0 disables CAN bus errors from triggering a fault in AC drive. This does not affect other CANopen faults, e.g. heartbeat consumer times. This value is the same as object 0x2004 - Communication timeout. See conditions when fieldbus communication timeout is activated in Chapter 9.2 Fieldbus timeout fault (F53).

Value	Description	Details
0	Normal	
1	Pre V008	Anyparameter service behaves same as version 7 and earlier in VACON [®] 100 family devices. See Chapter 8.5 for more details.

Table 56. OPTE6 Mode settings

Mode: compatibility mode(s) can be activated using this parameter. This parameter is the same as object 0x2005 - Mode.

7.1.1 OPTE6 ADDITIONAL PANEL PARAMETERS

From VACON $^{\otimes}$ 100 (INDUSTRIAL V027 and FLOW V018) and OPTE6 V009 firmware version forwards, CANopen bus communication parameters are stored and can also be modified directly from panel parameters. The stored parameters are modifiable and stored under the "Parameters" menu and these parameters are restored after power cycle. The active settings are visible under the "Monitor" menu.

These parameters are separated into sub-folders for easier modification. It is recommended to use $VACON^{\textcircled{\$}}$ Live PC-tool to modify the parameters.

General Heartbeat RPD01 Communication RPD02 Communication

^{*}Restricted availability, requires use of special application

COMMISSIONING VACON ● 55

Table 57. OPTE6 board CANopen object parameters under General folder

Panel Code VACON® 100	Parameter	Default	Reference	
5.x.3.6.1 COB-ID SYNC		0x80	3.7.4	
5.x.3.6.2 Guard Time		0	3.7.5	
5.x.3.6.3	Life Time Factor	0	3.7.6	
5.x.3.6.4	COB-ID EMCY	0x80 + Node ID	3.7.7	
5.x.3.6.5	Sync Counter Ovf.	0	3.7.11	
5.x.3.6.6	Error Behaviour	0	3.7.12	
5.x.3.7.1	Producer Time	0	3.7.9	
5.x.3.7.	Consumer Time 1	0		
5.x.3.7.3	Consumer Time 2	0		
5.x.3.7.4	Consumer Time 3	0		
5.x.3.7.5	Consumer Time 4	0	3.7.8	
5.x.3.7.6	Consumer Time 5	0	3.7.6	
5.x.3.7.7	Consumer Time 6	0		
5.x.3.7.8	Consumer Time 7	0		
5.x.3.7.9	Consumer Time 8	0		
5.x.3.8.1	COB-ID	0x200 + Node ID	3.5.2	
5.x.3.8.2	Transmission Type	0xFE		
5.x.3.8.3	Inhibit Time	0	3.5.3	
5.x.3.8.4	Event Timer	0		
5.x.3.9.1	COB-ID	0x80000300 + Node ID	ode ID 3.5.2	
5.x.3.9.2	Transmission Type	0xFE		
5.x.3.9.3	Inhibit Time	0	3.5.3	
5.x.3.9.4	Event Timer	0		
5.x.3.10.1	COB-ID	0x80000400 + Node ID	3.5.2	
5.x.3.10.2	Transmission Type	0xFE		
5.x.3.10.3	Inhibit Time	0	3.5.3	
5.x.3.10.4	Event Timer	0		
5.x.3.11.1	Number of Entries	2		
5.x.3.11.2	1 st Application Obj.	0x60400010		
5.x.3.11.3	2 nd Application Obj.	0x60420010	3.5.4	
5.x.3.11.4	3 rd Application Obj.	0		
5.x.3.11.5	4 th Application Obj.	0		

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Table 57. OPTE6 board CANopen object parameters under General folder

Panel Code VACON® 100	Parameter	Default	Reference	
5.x.3.12.1	Number of Entries	4		
5.x.3.12.2	1 st Application Obj.	0x20000410		
5.x.3.12.3	2 nd Application Obj.	0x20000510	3.5.4	
5.x.3.12.4	3 rd Application Obj. 0x20000610			
5.x.3.12.5	4 th Application Obj.	0x20000710	1	
5.x.3.13.1	Number of Entries	4		
5.x.3.13.2	1 st Application Obj.	0x20000810		
5.x.3.13.3	2 nd Application Obj.	0x20000910	3.5.4	
5.x.3.13.4	3 rd Application Obj.	0x20000A10		
5.x.3.13.5	4 th Application Obj.	0x20000B10		
5.x.3.14.1	COB-ID	0x180 + Node ID	3.5.2	
5.x.3.14.2	Transmission Type	0xFE		
5.x.3.14.3	Inhibit Time	100	0.50	
5.x.3.14.4	Event Timer	0	3.5.3	
5.x.3.14.5	Sync Start Value	0		
5.x.3.15.1	COB-ID	0x80000280 + Node ID	3.5.2	
5.x.3.15.2	Transmission Type	0xFE		
5.x.3.15.3	Inhibit Time	1000		
5.x.3.15.4	Event Timer	0	3.5.3	
5.x.3.15.5	Sync Start Value	0		
5.x.3.16.1	COB-ID	0x80000380 + Node ID	3.5.2	
5.x.3.16.2	Transmission Type	0xFE		
5.x.3.16.3	Inhibit Time	1000	0.5.0	
5.x.3.16.4	Event Timer	0	3.5.3	
5.x.3.16.5	Sync Start Value	0		
5.x.3.17.1	Number of Entries	2		
5.x.3.17.2	1 st Application Obj.	0x60410010		
5.x.3.17.3	2 nd Application Obj.	0x60440010	3.5.4	
5.x.3.17.4	3 rd Application Obj.	0		
5.x.3.17.5	4 th Application Obj.			
5.x.3.18.1	Number of Entries	4		
5.x.3.18.2	1 st Application Obj.	0x20010410		
5.x.3.18.3	2 nd Application Obj.	3.5.4		
5.x.3.18.4	2 nd Application Obj. 0x20010510 3.5 3 rd Application Obj. 0x20010610			
5.x.3.18.5	4 th Application Obj. 0x20010710			

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Panel Code VACON® 100	Parameter	Default	Reference
5.x.3.19.1	Number of Entries	4	
5.x.3.19.2	1 st Application Obj.	0x20010810	
5.x.3.19.3	2 nd Application Obj.	0x20010910	3.5.4
5.x.3.19.4	3 rd Application Obj.	0x20010A10	
5.x.3.19.5	4 th Application Obj.	0x20010B10	

Table 57. OPTE6 board CANopen object parameters under General folder

Considerations when modifying the CANopen object related parameters:

- All settings written to the CANopen related panel parameters are taken into use immediately if the value is valid
- No error is given if parameter value is invalid, instead the parameter value is restored back to previous value when read back
- Writing of an invalid value (for example 0) to a PDO mapping application object is not allowed. If a mapping must be invalidated, use the number of entries parameter to set the number of used objects
- All settings written via CANopen objects (bus parameters) are not automatically stored and visible in the panel parameters. Only after giving the "Save all parameters" command (object 0x1010,1), the parameters written from bus are stored to parameters
- Parameter #13 Error Behaviour is linked only to the Communication error (object 0x1029:01)

7.1.2 PANEL PARAMETER CHANGE REACTION

Changing of a parameter can change CANopen parameterization depending on what parameter is changed and what has been previously parameterized. This chapter clarifies the changes that occur in OPTE6 while parameters are changed from panel parameters or from CANopen objects that are linked to these parameters. Note that there are some differences between OPTE6 versions.

Changing of Node ID:

V008 and earlier: No difference to any stored parameter (listed in Table 57). This means that if the COB-IDs of e.g. PDO communication parameters need to be recalculated using the new Node ID one of the following actions must be performed:

- Change operate mode parameter (or toggle back and forth)
- Restore default parameter set from bus using the 0x1011 object and sending a reset node message

V009 forwards: COB-IDs are recalculated using the new Node ID and validity of COB-ID. Therefore, the following objects are changed:

Object	Name	New value if enabled	New value if disabled
0x1014	COB-ID EMCY	0x80 + Node ID	0x80000080 + Node ID
0x1400:01	(RPD01) COB-ID	0x200 + Node ID	0x80000200 + Node ID
0x1401:01	(RPD02) COB-ID	0x300 + Node ID	0x80000300 + Node ID
0x1402:01	(RPD03) COB-ID	0x400 + Node ID	0x80000400 + Node ID
0x1800:01	(TPD01) COB-ID	0x180 + Node ID	0x80000180 + Node ID

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Object	Name	New value if enabled	New value if disabled
0x1801:01	(TPD02) COB-ID	0x280 + Node ID	0x80000280 + Node ID
0x1802:01	(TPD03) COB-ID	0x380 + Node ID	0x80000380 + Node ID

Any heartbeat consumer entry using the new Node ID is reset to default value. No other parameters are affected.

If special PDO communication settings are used, these settings are overwritten and must be restored. They can be restored from bus, panel or PC-tool. It is recommended to create a user set (with PC-tool) before changing the Node ID setting and restoring it after changing Node ID (and Operate Mode).

Changing of Operate Mode:

V008 and earlier: All CANopen communication parameters are restored to use operate mode specific default values.

V009 forwards: Only PDO communication and mapping parameters are restored to use mode specific default values. CANopen communication objects such as Heartbeat and Node guarding are not modified.

Using "Restore from Set" parameter:

When writing any value (other than zero) to this parameter, all CANopen communication parameters are restored to default parameters and PDO communication and mapping parameters are restored to default parameters of the currently active operate mode.

Node ID, operate mode, baud rate, communication timeout and mode parameters are not affected. After the restore the parameter value is set back to zero automatically.

7.1.3 PARAMETER RESTORE

From VACON $^{\$}$ 100 (INDUSTRIAL V027 and FLOW V018) and OPTE6 V009 firmware version forwards, storing and restoring of CANopen parameters is possible using either Keypad or VACON $^{\$}$ Live PCtool.

If older version of OPTE6 or VACON $^{\circledR}$ 100 is used, parameter restore does not restore CANopen communication parameters. In this case, the old parameters that were stored in OPTE6 option board remain active. This means all parameters must be rewritten from bus if the option board is changed or parameters are cleared.

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7.2 OPTE6 PANEL MONITOR VALUES

Different number of panel monitoring values are visible depending on the used AC drive and version. $VACON^{@}$ 20 family option board monitoring values are under SYS menu.

Table 58. OPTE6 Monitoring Values

Panel code					
VACON® 100 family	VACON® 20 family	Parameter	Format	Description	
V5.x.2.1	V2.1	CANopen Status	NNNN.Y	NNNN = A running counter for incoming messages Y = Node CANopen status, see Table 59	
V5.x.2.2	-	Drive CW	-	Control word sent to AC drive from OPTE6	
V5.x.2.3	-	Drive SW	-	Status word received from AC drive	
V5.x.2.4	-	Protocol CW	-	Control word received from CANopen protocol	
V5.x.2.5	-	Protocol SW	-	Status word sent to CANopen protocol	

Table 59. Node CANopen status

Value	Description	
0	Initialising	
4	Stopped	
5	Operational	
6	Pre-operational	
7	Reset application	
8	Reset communication	

From VACON $^{\circledR}$ 100 (INDUSTRIAL V027 and FLOW V018) and OPTE6 V009 firmware version forwards, the active CANopen object values are visible as monitoring values. These values are the currently active settings and are equal to values read via CANopen objects. These objects might have different values than the stored parameters, depending if parameters written via bus are stored or not. The values are divided into subfolders same way as the corresponding parameters.

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7.3 UPDATING THE FIRMWARE OF OPTEON BOARD

The $VACON^{\circledR}$ Loader can be downloaded from http://drives.danfoss.com website. It has been bundled with the $VACON^{\circledR}$ Live software package.

To update the option board firmware, follow the steps below.

NOTE! With VACON[®] 20, the baud rate 9600 must be used. With VACON[®] 20 X and VACON[®] 20 CP, the following baud rates are supported: 9600, 19200, 38400 or 57600.

Step 1. Connect your PC to the controller by using the USB/RS485 cable.

Then select the firmware file which you want to load to the option board and double click it. This will start the VACON[®] Loader software. You can also start the program from the Windows Start menu. In this case, select the firmware file using the "Browse"-button (see Figure 12).



Figure 12. VACON® Loader: File selection

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Step 2. Press 'next' and wait for the loader to find the network drives.

Then select a drive from the list and press 'Connect to Selected'. See Figure 13.

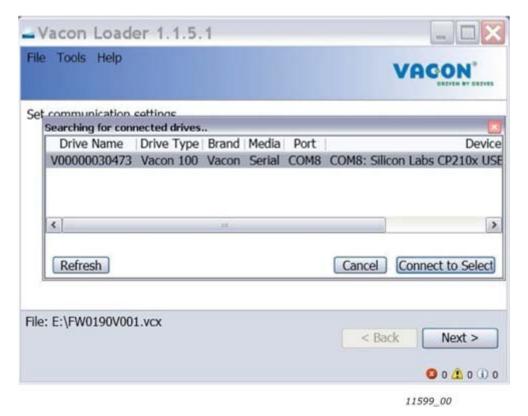


Figure 13. VACON® Loader: Connecting to drive

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Step 3. Select the modules to be updated, press 'next' and wait until the operation is finished. See Figure 14 and Figure 15.

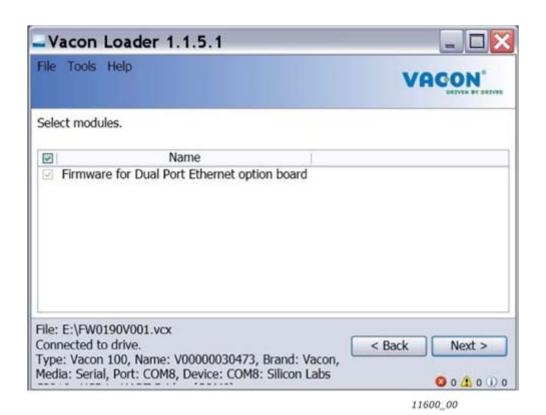


Figure 14. Option board module selection

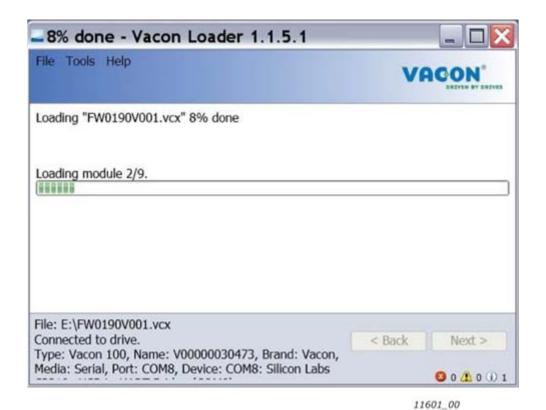


Figure 15. VACON® Loader: Firmware loading

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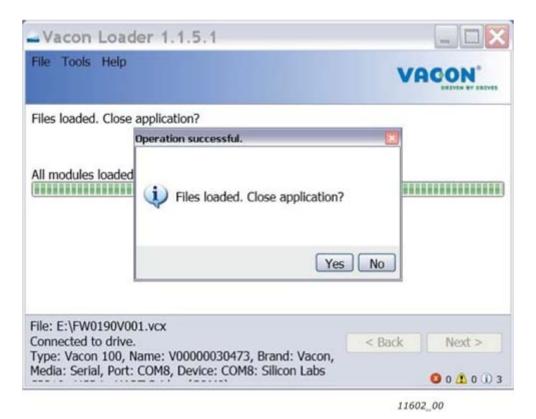


Figure 16. VACON® Loader: Loading is finished

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7.4 QUICK INSTRUCTIONS FOR CONTROLLING THE MOTOR

This chapter gives quick instructions on how to get the motor running using either CiA-402 velocity or Bypass mode using SDO protocol.

- 1. Set the OPTE6 jumpers, refer to Chapter 5.3
- 2. Install OPTE6 option board in VACON® AC drive and connect the CAN cable, refer to chapter 6 and 5.1
- 3. Set the option board parameters to establish CANopen communication. Refer to chapter 7.1.
- 4. Set the AC drive parameters so that it is controlled over fieldbus. Refer to Chapter 11 Appendix B Fieldbus parametrization

Drive profile:

Motor control mode should be set to Speed control. If it is not, Statusword has bit 0x4000 set.

If Statusword bit 0x200 is not set, the AC drive is not in fieldbus control mode and cannot be started via CANopen.

- 5. Set Controlword (0x6040) to 0x00
 - Statusword (0x6041) is 0x270
- 6. Set Controlword to 0x06
 - Statusword is 0x4231
- 7. Set Controlword to 0x0F
 - AC drive starts, Statusword is 0x637
- 8. Set vl target velocity (0x6042) to 500 (rpm)
 - Motor starts to run at 500 rpm (0x6044 vl velocity actual value)
 - If actual velocity does not change, check that AC drive reference is set to fieldbus

Bypass:

Motor control mode must be set to Frequency (if reference is given as percentage of maximum frequency).

- 5. Set FB Control Word (0x2000:01) to 0x00
 - FB Status Word (0x2001:01) is 0x41
- 6. Set FB Control Word to 0x01
 - AC drive starts, FB Status Word is 0x23
 - If AC drive does not start, check that AC drive is in fieldbus control mode
- 7. Set FB Speed Reference (0x2000:03) to 2500 = 25.00% of maximum frequency. Usually default value for maximum frequency is 50.00 Hz, so in this case the reference is 12.50 Hz.
 - FB Actual Speed (0x2001:03) is 2500 = 25.00% output frequency of maximum frequency
 - If actual speed does not change, check that AC drive reference is set to fieldbus

If motor control mode is set to Speed, the reference is given as a percentage of maximum frequency converted to rpm. In this case the FB Actual Speed should not be read as this holds the percentage related to output frequency. Therefore, the actual speed should be from process data out 2 (by default set to speed in rpm).

8. CANOPEN OPTION BOARD INTERFACE

By default, the CANopen option board is configured to operate in Drive Profile mode. The drive profile implementation is 'Velocity Mode' which is defined in CiA 402 specification with PDO set for the AC drive. The board can also be configured into Manufacturer specific mode.

8.1 SUPPORTED DRIVE MODES

Drive modes can be selected by writing the desired mode in Modes of Operation (0x6060) object or by selecting the mode from panel. The active mode of operation can be read from object Modes of Operation Display (0x6061).

The supported drive modes object will return value 0x80000002, which is described in table below.

Bit(s)	Description	
31	Manufacturer specific Bypass mode	
30-2	Not supported	
1	Velocity mode	
0	Not supported	

Table 60. Supported drive modes

Table 61. Drive modes

Value	Mode name	Description
2	Velocity mode	The CiA 402 Drive Profile mode where the control of the drive is done using a control word and speed reference value as specified in the drive profile specification.
-1	Bypass mode	In this mode, the Drive control can be done using raw process data which is exchanged with drive application. The drive profile state machine and the related objects become invalid.
-3	Puller mode	CiA (20 ELIDOMAD profiles Destricted availabil
-4	Co-Extruder mode	CiA 420 EUROMAP profiles. Restricted availability, requires use of special application.

Table 62. Operating mode related objects

Index	Description
0x6060	Modes of Operation
0x6061	Modes of Operation Display
0x6502	Supported Drive Modes

8.2 **VELOCITY MODE**

The velocity mode is one of the specific modes that CIA-402 Drive Profile defines. Common behaviour in all modes are PDS state machine, some control and status bits and certain objects.

8.2.1 PDS STATE MACHINE

The PDS state machine describes the generic start and stop sequence of the drive and the error behavior. The state machine is controlled by the Controlword object and internal events. The following objects are usable in velocity mode:

Table 63. Velocity mode related objects in OD

Index	Description
0x6040	Controlword
0x6041	Statusword
0x6042	VI Target Velocity
0x6043	Vl Velocity Demand
0x6044	Vl Velocity Actual Value
0x6046	Vl Velocity Min Max Amount
0x6048	Vl Velocity Acceleration
0x6049	Vl Velocity Deceleration

The possible state machine transitions can be seen from Figure 18. The state of the AC drive can be changed by writing the corresponding bits to Controlword data object. The needed bit values for each command can be seen from Figure 17.

Command	Bit	ts of the	Transitions			
Command	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	Transitions
Shutdown	0	Х	1	1	0	2.6.8
Switch on	0	0	1	1	1	3
Switch on + enable operation	0	1	1	1	1	3 + 4 (NOTE)
Disable voltage	0	Х	Х	0	Х	7,9,10,12
Quick stop	0	Х	0	1	Х	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset		X	X	Х	Х	15

NOTE Automatic transition to Enable operation state after executing SWITCHED ON state funtionality. ${}_{9422A_uk}$

Start Not ready to switch on xxxx xxxx x0xx 0000_h 1 15 Switch on disabled Fault XXXX XXXX X1XX 0000_b xxxx xxxx x0xx 1000_b 2 7 14 13 Ready to switch on Fault reaction active 10 xxxx xxxx x01x 0001_h XXXX XXXX X0XX 1111_b 12 6 3 Switched on 8 9 xxxx xxxx x01x 0011_b 5 Power-off or reset Quick stop active Operation enabled $xxxx xxxx x00x 0111_{b}$ XXXX XXXX X01X 0111_b 11 9401.emf

Figure 17. Controlword commands

Figure 18. Power Drive System state machine

The table below explains the actions taken in different state transitions and which event triggers which state transition. If the used drive/application does not support different stop bits in Fixed Control Word, the stop method will always be according to set stop function.

Table 64. State transition events and actions

Transition	Event(s)	Action(s)
0	Automatic transition after power-on or reset	Self-initialization is performed
1	Automatic transition after drive status is 'ready'	None
2, 6	Shutdown command	None
3	Switch on command	None
4	Enable operation command	Drive function is enabled
5	Disable operation command	Drive function is disabled
7	Disable voltage or quick stop command	None
8	Shutdown command	Stop by ramp /stop function
9	Disable voltage command	Stop by coast / stop function
10, 12	Disable voltage command	None
11	Quick stop command	Quick stop / stop function
13	Fault signal	Go to fault state and stop by stop function
14	Automatic transition	None
15	Fault reset command	Reset fault if no fault currently exists on drive

Current state can be determined by reading the value of Statusword data object and comparing the value of bits to the table below.

Table 65. Statusword bits

Bits of	Bits of the statusword						DDC state		
15-8	7	6	5	4	3	2	1	0	- PDS state
Х	Х	0	Х	Χ	0	0	0	0	Not ready to switch on
Х	Х	1	Х	Х	0	0	0	0	Switch on disabled
Х	Х	0	1	Х	0	0	0	1	Ready to switch on
Х	Х	0	1	Х	0	0	1	1	Switched on
Х	Х	0	1	Х	0	1	1	1	Operation enabled
Х	Х	0	0	Х	0	1	1	1	Quick stop active
Х	Х	0	Х	Х	1	1	1	1	Fault reaction active
Х	Х	0	Х	Х	1	0	0	0	Fault
x = Do not care									

8.2.2 CIA-402 OBJECTS

Controlword is used to control the drive operation according to the PDS state machine. By default, Controlword is mapped into the first two bytes of rxPD01.

Table 66. 0x6040: Controlword

В	Bit	Name	Description
12-15	na	Not used	Bits 12 through 15 are not in use.
11	ar	Alarm reset	Rising edge resets alarm
10	r	Reserved	Bit 10 is not in use
9	oms	Operation mode specific	Bit 9 is not in use
8	h	Halt	Bit 8 is not in use
7	fr	Fault reset	Rising edge resets fault
4-6	na	Not Used	Bits 4 through 6 are not in use.
3	ео	Enable operation	Start drive
2	qs	Quick stop	Stops the drive using the drive/application specific stop function used as quick stop
1	ev	Enable voltage	Enables/disables output voltage
0	S0	Switch on	Enables possibility to start drive together with ev

Statusword indicates whether the drive is in remote control and if the target velocity is reached. By default, Statusword is mapped into the first two bytes of txPD01.

Table 67. 0x6041: Statusword

В	it	Name	Description		
15	na	Not in use	Bit 15 is not in use		
14	idm	Incorrect drive mode	Indicates that the drive is in incorrect "Control mode" for the used CiA-402 profile		
12-13	oms	Operation mode specific	Bits 12 through 13 are not in use		
10	tr	Target reached	Target velocity reached		
9	rm	Remote	Indicates if the drive is controllable by Fieldbus		
8	na	Not in use	Bit 8 not in use.		
7	W	Warning	The AC drive has an active Alarm.		
6	sod	Switch on disabled	PDS switch on disable		
5	qs	Quick stop	PDS quick stop active		
4	ve	Voltage enabled	Voltage is enabled		
3	f	Fault	PDS Fault (indicates fault condition)		
2	oe	Operation enabled	PDS operation enabled (drive is running)		
1	50	Switched on	PDS switched on		
0	rtso	Ready to switch on	PDS ready to switch on		

8.2.2.3 OX6042 - vl Target Velocity

The signed value of motor rpm speed request to drive. A negative value means that the motor is running clockwise. By default, the object is mapped into the last two bytes of rxPD01.

Range: -32768...32767

0x6042:vl Target Velocity	
15	0
Rpm request to drive	

8.2.2.4 OX6043 - vl Velocity Demand

The signed read-only value of the ramp generator output scaled into rpm. A negative value means that the motor is running clockwise. By default, the object is not mapped into any PDO.

Range: -32768...32767

	0x6043:vl Velocity Demand	
15		0
	Drive ramp generator output scaled into rpm	

8.2.2.5 OX6044 - vl Velocity Actual Value

The signed value of the motor actual rpm speed. A negative value means that the motor is running clockwise. By default, the object is mapped into the last two bytes of txPD01.

Range: -32678...32767

	0x6044:vl Velocity Actual Value
15	0
	Motor actual rpm speed

8.2.2.6 OX6046 - vl Velocity Min Max Amount

The minimum and maximum rpm speed of the AC drive's motor. The motor runs on minimum speed defined here when the vl Target Velocity is set to 0.

	0x6046.01: vl Velocity Min Amount	
31		0
	Motor minimum rpm speed	

0x6046.02: vl Velocity Max Amount					
31	0				
Motor maximum rpm speed					

Range: 0... 4294967296

8.2.2.7 OX6048 - vl Velocity Acceleration

This object indicates the configured delta speed and delta time of the slope of the acceleration ramp.

0x6048.01: Delta speed						
31		0				
	Maximum change of rpm the motor will accelerate during the time specified in Delta Time.					

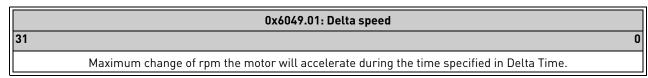
Range: 0... 4294967296

	0x6048.02: Delta time	
16		0
	Time (in seconds) in which the rpm of the motor will accelerate the amount specified in Delta Speed.	

Range: 0... 65536

8.2.2.8 OX6049 - vl Velocity Deceleration

This object indicates the configured delta speed and delta time of the slope of the deceleration ramp.



Range: 0... 4294967296

	0x6049.02: Delta time						
16		0					
	Time (in seconds) in which the rpm of the motor will accelerate the amount specified in Delta Speed.						

Range: 0... 65536

8.2.3 PDO CONFIGURATION

This chapter describes the default PDO mapping configuration when using CiA-402 velocity mode. By default, RPDO/TPDO 2 & 3 are disabled. These settings are restored when:

- changing the operate mode to "Velocity" from either panel or object 0x6060
- using the "Restore from Set" panel parameter when Velocity operate mode is selected, or
- loading a default parameter set with object 0x1011, 1 "Restore all Default parameters"

When the parameter set is restored, the COB-IDs are calculated according to used Node ID.

Table 68. Overview of Receive PDO configuration in CiA-402 vl mode

Object	COB-ID	Size	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
RPD01	0x200 + Node ID	4	0x6040, Controlword		0x6042, vl Target Velocity		Not used			
RPD02	0x80000300 + Node ID	8	0x2000,4 FB PD in 1			00,5 D in 2	0x2000,6 FB PD in 3		0x20 FB PI	,
RPD03	0x80000400 + Node ID	8	0x2000,8 FB PD in 5			00,9 D in 6	•		0x20 FB PI	

Object COB-ID Size DATA0 DATA1 DATA2 DATA3 DATA4 DATA5 DATA6 DATA7 0x180 +0x6041. 0x6044. TPD01 4 Not used Node ID Statusword vl Velocity Actual 0x80000280 0x2001,4 0x2001.5 0x2001,6 0x2001.7 TPD02 8 + Node ID FB PD out 1 FB PD out 2 FB PD out 3 FB PD out 4 0x80000380 0x2001,8 0x2001,9 0x2001,A 0x2001,B TPD03 8 + Node ID FB PD out 5 FB PD out 6 FB PD out 7 FB PD out 8

Table 69. Overview of Transmit PDO configuration in CiA-402 vl mode

8.2.3.1 Receive PDO configuration

Configuration of the receive PDO configuration is the following, when the CiA-402 vl parameter set is restored:

Sub-index Index Value Name Access Data type 0 Number of entries **UNSIGNED8** 2 r/w 0x1600 1 0x60400010 Controlword **UNSIGNED32** r/w 2 0x60420010 vl Target Velocity **UNSIGNED32** r/w

Table 70. Receive PDO Mapping Parameter 1

Table 71. Re	ceive PDO	Mapping	Parameter	2
--------------	-----------	---------	-----------	---

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20000410	FB PD in 1*	UNSIGNED32	r/w
0x1601	2	0x20000510	FB PD in 2*	UNSIGNED32	r/w
	3	0x20000610	FB PD in 3*	UNSIGNED32	r/w
	4	0x20000710	FB PD in 4*	UNSIGNED32	r/w

 $[\]ensuremath{^*}$ Data inside 'FB PD in' varies according to the drive application and used settings.

Table 72. Receive PDO Mapping Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20000810	FB PD in 5*	UNSIGNED32	r/w
0x1602	2	0x20000910	FB PD in 6*	UNSIGNED32	r/w
	3	0x20000A10	FB PD in 7*	UNSIGNED32	r/w
	4	0x20000B10	FB PD in 8*	UNSIGNED32	r/w

^{*} Data inside 'FB PD in' varies according to the drive application and used settings.

Table 73. Receive PDO Communication Parameter 1

Index	Sub-index	Value Name		Data type	Access
	0	5	Highest sub-index	UNSIGNED8	ro
	1	0x200 + Node ID	COB-ID	UNSIGNED32	r/w
0x1400	2	0xFE	Transmission type	UNSIGNED32	r/w
	3	100	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w

Table 74. Receive PDO Communication Parameter 2

Index	Sub-index	Value	Name	Data type	Access
	0	5	Highest sub-index	UNSIGNED8	ro
	1	0x80000300 + Node ID	COB-ID	UNSIGNED32	r/w
0x1401	2	0xFE	Transmission type	UNSIGNED32	r/w
	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w

Table 75. Receive PDO Communication Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	5	Highest sub-index	UNSIGNED8	ro
	1	0x80000400 + Node ID	COB-ID	UNSIGNED32	r/w
0x1402	2	0xFE	Transmission type	UNSIGNED32	r/w
	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w

8.2.3.2 <u>Transmit PDO configuration</u>

Configuration of the transmit PDO configuration is the following, when the CiA-402 vl parameter set is restored:

Table 76. Transmit PDO Mapping Parameter 1

Index	Sub-index	Value	Name	Data type	Access
	0	2	Number of entries	UNSIGNED8	r/w
0x1A00	1	0x60410010	Statusword	UNSIGNED32	r/w
	2	0x60440010	vl Velocity Actual Value	UNSIGNED32	r/w

lex	Value	Name	Data type
Tabl	le 77. Transmit P	DO Mapping Paramet	ter 2

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20001410	FB PD out 1*	UNSIGNED32	r/w
0x1A01	2	0x20001510	FB PD out 2*	UNSIGNED32	r/w
	3	0x20001610	FB PD out 3*	UNSIGNED32	r/w
	4	0x20001710	FB PD out 4*	UNSIGNED32	r/w

^{*} Data inside 'FB PD in' varies according to the drive application and used settings.

Table 78. Transmit PDO Mapping Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20001810	FB PD out 5*	UNSIGNED32	r/w
0x1A02	2	0x20001910	FB PD out 6*	UNSIGNED32	r/w
	3	0x20001A10	FB PD out 7*	UNSIGNED32	r/w
	4	0x20001B10	FB PD out 8*	UNSIGNED32	r/w

^{*} Data inside 'FB PD out' varies according to the drive application and used settings.

Table 79. Transmit PDO Communication Parameter 1

Index	Sub-index	Value Name		Data type	Access
	0	6	Highest sub-index	UNSIGNED8	ro
	1	0x180 + Node ID	COB-ID	UNSIGNED32	r/w
01000	2	0xFE	Transmission type	UNSIGNED32	r/w
0x1800	3	100	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w
	6	0	Sync start value	UNSIGNED8	r/w

Table 80. Transmit PDO Communication Parameter 2

Index	Sub-index	Value Name		Data type	Access
	0	6	Highest sub-index	UNSIGNED8	ro
	1	0x80000280 + Node ID	COB-ID	UNSIGNED32	r/w
0x1801	2	0xFE	Transmission type	UNSIGNED32	r/w
UXIOUI	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w
	6	0	Sync start value	UNSIGNED8	r/w

Index Sub-index Value Name Data type Access 0 6 Highest sub-index **UNSIGNED8** ro 0x80000380 + 1 COB-ID **UNSIGNED32** r/w Node ID 2 0xFE UNSIGNED32 Transmission type r/w 0x1802 3 1000 UNSIGNED16 r/w Inhibit time Reserved **UNSIGNED8** 4 ro 5 0 Event timer **UNSIGNED16** r/w **UNSIGNED8** 6 0 Svnc start value r/w

Table 81. Transmit PDO Communication Parameter 3

8.3 BYPASS MODE

In bypass mode, some data defined in the profile is invalid, and the drive control is done using raw process data. The raw process data arrays are located in the manufacturer specific objects 0x2000 and 0x2001. There are two arrays: one for incoming data and one for outgoing data.

The drive application defines what data is mapped into the outgoing process data and how the incoming process data is handled. See 12. Appendix C - Fieldbus Process Data mapping and scaling for more details.

8.3.1 PDO CONFIGURATION

This chapter describes the default PDO mapping configuration when using Bypass mode. These settings are restored when:

- changing the operate mode to "Bypass" from either panel or object 0x6060
- using the "Restore from Set" panel parameter when Bypass operate mode is selected, or
- loading a default parameter set with object 0x1011,4 "Restore Bypass parameter set" and sending a NMT reset message

When the parameter set is restored, the COB-IDs are calculated according to used Node ID.

Object COB-ID Size DATAO DATA1 DATA2 DATA3 DATA4 DATA5 DATA6 DATA7 0x2000.2 0x2000.3 0x200 +0x2000.1. Not used RPD01 FB General FB Speed 6 Node ID Controlword Control Word Reference 0x300 +0x2000.40x2000.5 0x2000.6 0x2000.7RPD02 8 Node ID FB PD in 1 FB PD in 2 FB PD in 3 FB PD in 4 0x2000,B 0x400 +0x2000,8 0x2000,9 0x2000,A RPD03 8 Node ID FB PD in 5 FB PD in 6 FB PD in 7 FB PD in 8

Table 82. Overview of Receive PDO configuration in Bypass mode

Object	COB-ID	Size	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
TPD01	0x180 + Node ID	6	0x20 FB State	01,1 us Word	0x20 FB Ge Status	eneral	0x20 FB Actua	01,3 al Speed	Not	used
TPD02	0x280 + Node ID	8	0x20 FB PD		0x20 FB PD	01,5) out 2	0x20 FB PD	01,6) out 3	0x20 FB PD	101,7) out 4
TPD03	0x380 + Node ID	8	0x20 FB PD		0x20 FB PD	01,9) out 6	0x20 FB PD		0x20 FB PD	01,B) out 8

Table 83. Overview of Transmit PDO configuration in Bypass mode

8.3.1.1 Receive PDO configuration

Configuration of the receive PDO configuration is the following, when the Bypass parameter set is restored:

Index	Sub-index	Value	Name	Data type	Access
	0	3	Number of entries	UNSIGNED8	r/w
	1	0x20000110	FB Control Word	UNSIGNED32	r/w
0x1600	2	0x20000210	FB General Control Word	UNSIGNED32	r/w
	3	0x20000310	FB Speed Reference	UNSIGNED32	r/w

Table 84. Receive PDO Mapping Parameter 1

Table 85.	Receive	PDO	Mapping	Parameter 2	2
		. – –			-

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20000410	FB PD in 1*	UNSIGNED32	r/w
0x1601	2	0x20000510	FB PD in 2*	UNSIGNED32	r/w
	3	0x20000610	FB PD in 3*	UNSIGNED32	r/w
	4	0x20000710	FB PD in 4*	UNSIGNED32	r/w

^{*} Data inside 'FB PD in' varies according to the drive application and used settings.

Table 86. Receive PDO Mapping Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20000810	FB PD in 5*	UNSIGNED32	r/w
0x1602	2	0x20000910	FB PD in 6*	UNSIGNED32	r/w
	3	0x20000A10	FB PD in 7*	UNSIGNED32	r/w
	4	0x20000B10	FB PD in 8*	UNSIGNED32	r/w

^{*} Data inside 'FB PD in' varies according to the drive application and used settings.

Table 87. Receive PDO Communication Parameter 1

Index	Sub-index	Value	Name	Data type	Access
	0	5	Highest sub-index	UNSIGNED8	ro
	1	0x200 + Node ID	COB-ID	UNSIGNED32	r/w
0x1400	2	0xFE	Transmission type	UNSIGNED32	r/w
	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w

Table 88. Receive PDO Communication Parameter 2

Index	Sub-index	Value	Name	Data type	Access
	0	5	Highest sub-index	UNSIGNED8	ro
	1	0x300 + Node ID	COB-ID	UNSIGNED32	r/w
0x1401	2	0xFE	Transmission type	UNSIGNED32	r/w
	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w

Table 89. Receive PDO Communication Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	5	Highest sub-index	UNSIGNED8	ro
	1	0x400 + Node ID	COB-ID	UNSIGNED32	r/w
0x1402	2	0xFE	Transmission type	UNSIGNED32	r/w
	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w

8.3.1.2 <u>Transmit PDO configuration</u>

Configuration of the transmit PDO configuration is the following, when the Bypass parameter set is restored:

Table 90. Transmit PDO Mapping Parameter 1

Index	Sub-index	Value	Name	Data type	Access
	0	2	Number of entries	UNSIGNED8	r/w
0x1A00	1	0x20010110	FB Status Word	UNSIGNED32	r/w
0.1700	2	0x20010210	FB General Status Word	UNSIGNED32	r/w
	3	0x20010310	FB Actual Speed	UNSIGNED32	r/w

Table 91. Transmit PDO Mapping Parameter 2

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20010410	FB PD out 1*	UNSIGNED32	r/w
0x1A01	2	0x20010510	FB PD out 2*	UNSIGNED32	r/w
	3	0x20010610	FB PD out 3*	UNSIGNED32	r/w
	4	0x20010710	FB PD out 4*	UNSIGNED32	r/w

^{*} Data inside 'FB PD in' varies according to the drive application and used settings.

Table 92. Transmit PDO Mapping Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	4	Number of entries	UNSIGNED8	r/w
	1	0x20010810	FB PD out 5*	UNSIGNED32	r/w
0x1A02	2	0x20010910	FB PD out 6*	UNSIGNED32	r/w
	3	0x20010A10	FB PD out 7*	UNSIGNED32	r/w
	4	0x20010B10	FB PD out 8*	UNSIGNED32	r/w

^{*} Data inside 'FB PD out' varies according to the drive application and used settings.

Table 93. Transmit PDO Communication Parameter 1

Index	Sub-index	Value	Name	Data type	Access
	0	6	Highest sub-index	UNSIGNED8	ro
	1	0x180 + Node ID	COB-ID	UNSIGNED32	r/w
0,4000	2	0xFE	Transmission type	UNSIGNED32	r/w
0x1800	3	100	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w
	6	0	Sync start value	UNSIGNED8	r/w

Table 94. Transmit PDO Communication Parameter 2

Index	Sub-index	Value	Name	Data type	Access
	0	6	Highest sub-index	UNSIGNED8	ro
	1	0x280 + Node ID	COB-ID	UNSIGNED32	r/w
0,4001	2	0xFE	Transmission type	UNSIGNED32	r/w
0x1801	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w
	6	0	Sync start value	UNSIGNED8	r/w

Table 95. Transmit PDO Communication Parameter 3

Index	Sub-index	Value	Name	Data type	Access
	0	6	Highest sub-index	UNSIGNED8	ro
	1	0x380 + Node ID	COB-ID	UNSIGNED32	r/w
0,4000	2	0xFE	Transmission type	UNSIGNED32	r/w
0x1802	3	1000	Inhibit time	UNSIGNED16	r/w
	4	-	Reserved	UNSIGNED8	ro
	5	0	Event timer	UNSIGNED16	r/w
	6	0	Sync start value	UNSIGNED8	r/w

8.4 DEFAULT PROCESS DATA APPLICATION MAPPING

This chapter describes the default mapping of the OPTE6 process data variables to the application data in the drive. It also provides a description of the application data in the drive. Supported control/status word bits might differ depending on used application. Please read also the corresponding section of the drive's application manual for additional information.

Table 96. Process data in

Sub-index	Mapped Application data	
In Offset0	FB Control word	
In Offset 1	FB Control word Extension	
In Offset 2	FB Speed reference	
In Offset 3	FB Process data in 01	
In Offset 4	FB Process data in 02	
In Offset 5	FB Process data in 03	
In Offset 6	FB Process data in 04	
In Offset 7	FB Process data in 05	
In Offset 8	FB Process data in 06	
In Offset 9	FB Process data in 07	
In Offset 10	FB Process data in 08	

Table 97. Process data out

Sub-index	Mapped Application data
Out Offset 0	FB Status Word
Out Offset 1	FB Status Word Extension
Out Offset 2	FB Actual Speed
Out Offset 3	FB Process data out 01
Out Offset 4	FB Process data out 02
Out Offset 5	FB Process data out 03
Out Offset 6	FB Process data out 04
Out Offset 7	FB Process data out 05
Out Offset 8	FB Process data out 06
Out Offset 9	FB Process data out 07
Out Offset 10	FB Process data out 08

8.4.1 FB CONTROL WORD

Mapped into FB PD in offset 0.

Table 98. FB Control Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	ı	ESTP	JOG2	JOG1	BREF	BCTRL	ZREF	FRMP	ZRMP	STPM2	STPM1	FRST	DIR	STRT

Table 99. FB Control Word description

	Bit	Name	Description	0	1
12	ESTP	Emergency Stop	Request as fast stop as possible	-	Emergency stop
11	JOG2	Jogging request	Select jogging with reference 2	-	Select ref2 jogging
10	JOG1	Jogging request	Select jogging with reference 1	-	Select ref1 jogging
9	BREF	Bus Reference	Force Reference to fieldbus	Selected reference place	Force Fieldbus refer- ence
8	BCTRL	Bus Control	Force fieldbus control active	Selected control place	Force Fieldbus Control
7	ZREF	Zero Ref	Force reference to zero	-	Force reference to zero
6	FRMP	Ramp Freeze	Freeze ramp generator	-	Freeze ramp generator
5	QRMP	Quick Ramp Time	Use quick ramp time	Normal ramp time	Quick ramp time
4	STPM2	Stop Mode2	Stop mode ramping	-	Stop By Ramp mode
3	STPM1	Stop Mode1	Stop mode coasting	-	Coasting Stop Mode
2	FRST	Fault Reset	Request fault reset from drive	-	Request reset from drive
1	DIR	Direction	Rotation direction	Clockwise	Counter clockwise
0	STRT	Start / Stop	Start / Stop request	Stop	Run

8.4.2 FB CONTROL WORD EXTENSION (GENERAL CONTROL WORD)

Mapped into FB PD in offset 1.

Table 100. FB Control Word Extension

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
BSTAT2	BSTAT1	BFLT	-	ı	1	1	1	1	1	ı	1	-	-	1	-

Table 101. FB Control Word extension description

	Bit	Name	Description	0	1
15	BSTAT2	Bus status	Informs bus status into application	Status of d	option board
14	BSTAT1	Bus status	Informs bus status into application		
13	3 BFLT Bus fault Red		Request fieldbus fault	-	Generate field bus fault

8.4.3 FB SPEED REFERENCE

Mapped into FB PD in offset 2.

Table 102. FB Speed Reference

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
FB Speed Reference															

Table 103. FB Speed reference description

Name	Description	Min	Max
FB Speed Reference	Frequency reference at percentage between minimum and maximum frequency. Control word DIR bit is used to select rotation direc-	0 (0%)	10000 (100.00%)
	tion.		

8.4.4 FB PROCESS DATA INPUT 1...8

Mapped into FB PD in offset 3...11.

Table 104. FB Process Data Input 1...8

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
						FB F	FB Process data in											

8.4.5 FB PROCESSDATA INPUT MAPPING IN APPLICATION

In addition to sending control commands and speed reference values to the application, 8 process data items can be sent directly to the application to control other features via fieldbus. These can be, for example, activating preset frequencies, activating or deactivating faults, selecting different ramp times, controlling I/O's, and so on. Different applications support different features. For more information, see the application manual. Also, always check the value of the sent data in the application manual to see in which format they are given (for example, % values, bit coded values, and so on).

Table 105. FB Processdata application mapping

PD	Mapped Application Data	Unit
PD in 1	-	-
PD in 2	-	-
PD in 3	-	-
PD in 4	-	-
PD in 5	-	-
PD in 6	-	-
PD in 7	-	-
PD in 8	-	-

8.4.6 FB STATUS WORD

Mapped into FB PD out offset 0.

Table 106. FB Status Word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	ı	ı	ı	1	ı	ı	FRDY	ZSPD	ATREF	ALARM	FLT	DIR	RUN	RDY

Table 107. FB Status word description

	Bit	Name	Description	0	1
7	FRDY	Flux ready	Motor magnetization is ready	-	Flux ready
6	ZSPD	Zero speed	Motor is running on zero speed	-	Zero speed condition
5	ATREF	At reference	Reference frequency is reached	-	Reference reached
4	ALARM	Alarm	Alarm indication	-	Drive is in Alarm
3	FLT	Faulted	Drive fault indicatioin	-	Drive is Faulted
2	DIR	Direction	Motor running direction	Clockwise	Counter clockwise
1	RUN	Run	Motor running information	Stopped	Running
0	RDY	Ready	Drive readiness information	-	Ready

8.4.7 FB STATUS WORD EXTENSION (GENERAL STATUS WORD)

Mapped into FB PD out offset 1.

Table 108. FB Status word extension

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CP3	CP2	CP1	1	1	-	-	-	-	-	-	-	-	-	-	-

Table 109. FB Status word extension description

	Bit Name		Description	0	1
15	CP3	Control Place	Drive Control place information	0,0,1-(1) Fieldbus
14	CP2				(2) Panel
13	CP1				- (3) Tool) - (4) I/O

8.4.8 FB ACTUAL SPEED

Mapped into FB PD out offset 2.

Table 110. FB Actual Speed

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
						FB Actual Speed									

Table 111. FB Actual Speed description

Name	Description	Min	Max
FB Actual Speed	Actual output frequency at percentage	0	10000
	between minimum and maximum frequency.	(0%)	(100.00%)
	Status word bit DIR is used to indicate actual		
	direction.		

8.4.9 FB PROCESSDATA OUTPUT 1...8

Mapped into FB PD out offset 3...11

Table 112. FB Process data output 1...8

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	FB Process data Out 18														

8.4.10 FB PROCESSDATA OUTPUT MAPPING IN APPLICATION

Process data output mappings are selectable and also the default settings vary between drives. Refer to application manual for details. The following tables show the default values for VACON $^{\$}$ 100 INDUSTRIAL application, VACON $^{\$}$ 20 X Multipurpose Application and VACON $^{\$}$ 20 Standard Application.

Table 113. Process data output mapping defaults for $VACON^{@}$ 100 GP and $VACON^{@}$ 20X

PD Out	Application	Mapped Application Data	Unit	Scale
1	VACON® 100 INDUSTRIAL	Output Frequency	Hz	0.01Hz
	VACON® 20 X MP	Output Current	А	0.1 A
2	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	Motor Speed	Rpm	1 rpm
3	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	Motor Current	А	0.1A
4	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	Motor Torque	%	0.1%
5	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	Motor Power	%	0.1%
6	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	Motor Voltage	V	0.1V
7	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	DC Link Voltage	V	1V
8	VACON [®] 100 INDUSTRIAL & VACON [®] 20 X MP	Last Active Fault Code	-	-

Table 114. Process data output mapping defaults for VACON® 20 Standard Application

PD Out	Mapped Application Data	Unit	Scale
1	Frequency Reference	Hz	0.01Hz
2	Output Reference	Hz	0.01Hz
3	Motor Speed	Rpm	1rpm
4	Motor Voltage	٧	0.1V
5	Motor Torque	%	0.1%
6	Motor Current	А	0.01A
7	Motor Power	%	0.1%
8	DC Link Voltage	٧	1 V

8.5 VACON ANYPARAMETER SERVICE

For access to AC drive parameters and monitoring values, the OPTE6 maps the CANopen manufacturer segment 0x2100 - 0x5FFF into the application IDs of the drive based on the IEC61131 standard. Both read and write access is supported.

The application ID 1 maps to CANopen object 0x2101 and so on, making it possible to read/write any application ID between 1 and 16127 (0x3EFF). To access the application IDs in the drive, make the following calculation:

Index = ID number + 0x2100

NOTE! The response data is in raw format. See application manual for available IDs, decimal count and the unit used for the parameters.

IDs can be read/written as VACON[®] NX scaled values in all AC drives, or in VACON[®] 100 family AC drives also as actual raw value. Units such as Hz, rpm, A, V, etc. are given with 4 decimal point precision. See examples for more details.

The used scale in VACON $^{(8)}$ 100 family depends on the "Mode" parameter setting. This can be written from panel parameter of by using CANopen object 0x2005.

 $VACON^{\$}$ provides .EDS files which contains the correct data types and IDs for $VACON^{\$}$ 100 INDUSTRIAL, FLOW, $VACON^{\$}$ 20 and 20X applications.

These files can be downloaded from www.drives.danfoss.com.

8.5.1 ERROR RESPONSES

In case an error occurs during reading or writing a parameter via the anyparameter service, the following SDO abort error codes are returned:

Abort code	Description	Error
0x0602 0000	Object does not exist in the object dictionary	ID is not found in used application
0x0601 0002	Attempt to write a read only object	ID is a monitoring value
0x0607 0010	Data type does not match, length of service parameter does not match	Data length does not match ID data type
0x06090030	Invalid value for parameter (download only).	Data value is invalid
0x0800 0000	General error	Other error
0x0800 0024	No data available	Parameter access timeout

Table 115. ADO abort codes returned by anyparameter service

8.5.2 EXAMPLES

In the examples below, the following ID values are used:

- 102 = Maximum frequency (Hz)
- 600 = Motor control mode

Table 116. Example 1: Reading values from different AC drives

AC drive	Mode	Read	command		Re	esponse			
AC dilve	Mode	ID	Index	Length	Hex (LSB)	Dec (MSB)	Actual value		
VACON® 20 family	Any	102	0x2166	2	88 13	5000	50.00 Hz		
VACON® 100 family	Pre V008	600	0x2358	2	01 00	1	1 = OL Speed		
VACON® 100 family	Normal	102	0x2166	4	20 A1 07 00	500000	50.0000 Hz		
VACON TOO TAITING	Normal	600	0x2358	4	01 00 00 00	1	1 = OL Speed		

AC drive	Mode		Write	Actual value		
AC di IVe	Mode	ID Index Length Value (Hex)		Actual Value		
VACON® 20 family	Any	102	0x2166	2	94 11	45.00 Hz
VACON® 100 family	Pre V008	600	0x2358	2	00 00	0 = OL Frequency
VACON® 100 family	Normal	102	0x2166	4	D0 DD 06 00	45.0000 Hz
VACON TOO Idiffilly	Normat	600	0x2358	4	00 00 00 00	0 = OL Frequency

FAULT TRACING VACON ● 87

9. FAULT TRACING

When the option board or the AC drive control diagnostics detect an unusual operating condition, the drive opens a notification, for example, on the keypad. The keypad shows the ordinal number of the fault, the fault code and a short fault description.

You can reset the fault with the Reset button on the control keypad, via the I/O terminal or via the used fieldbus protocol. The faults are stored in the Fault history menu, which can be browsed. The fault table presents only the fault conditions related to the fieldbus in use.

NOTE! When you contact a distributor or a factory because of a fault condition, always write down all the texts and codes on the keypad display. Then send detailed problem description together with the Drive Info (Service Info) File to the local distributor. See local contacts: http://drives.danfoss.com/danfossdrives/local-contacts/. If possible, also send CAN communication log from the fault situation if applicable.

9.1 TYPICAL FAULT CONDITIONS

Table 117. Typical fieldbus fault conditions

Fault condition		Possible cause	Remedy	
		Supply or motor cables are located too close to the fieldbus cable	Refer to 6.2 (part 9)	
	Cabling	Wrong type of fieldbus cable, e.g. insufficient shielding	Refer to 4.2	
		Too long cabling		
No communication		Invalid termination	Refer to 5.3 and 4.2.1	
	Grounding	Inadequate or invalid grounding	Refer to 5.3 and 4.2.1	
		Excessive stripping of cables	Refer to 6.2	
	Connections	Conductors in wrong terminals	Refer to 5.1	
		Too loose connections of conductors	There to 5.1	
Faulty communication		Overlapping Node ID	Refer to 7.1	
raulty communication		Wrong baud rate	Refer to 7.1	
Drive does not start	Parametriza- tion	PDO mapping is invalid	Refer to 7.1 and 3.5	
		Wrong control place selected		
Drive runs at wrong speed		Wrong motor control mode selected	Refer to 11.	
Fieldbus fault (F53)	Fieldbus	See chapter 9.2		

VACON ● 88 FAULT TRACING

9.2 FIELDBUS TIMEOUT FAULT (F53)

VACON[®] fieldbuses create a fieldbus timeout fault (F53) when a fault has occurred in the fieldbus protocol and the AC drive is set to fieldbus control. If the control place is set to e.g. I/O, no fieldbus fault is triggered even if a fault condition is met. The fault response can also be modified in the AC drive application, see chapter 11.2 for more details.

OPTE6 creates a fieldbus fault in the following conditions:

Table 118. OPTE6 Fieldbus fault trigger conditions

Fault	Description	Remedy
CAN Passive	 "Communication timeout" parameter is other than zero Either Transmit Error Counter or Receive Error Counter raises above 127, causing the CAN driver to go into passive state 	 Check cabling and baud rates of all nodes in network Disable communication timeout or increase the
CAN BUS- OFF	 "Communication timeout" parameter is other than zero Transmit Error Counter raises above 255, causing the CAN driver to go into bus-off state 	time.
Heartbeat Consumer	 Heartbeat consumer is set At least one valid heartbeat message has been received The heartbeat time has elapsed 	 Check Heartbeat Consumer time Check heartbeat producer time of the producer CANopen node Increase Heartbeat Time Check cabling
Node Guard	 Guard Time and Life Time Factor are set, At least one valid node guard message has been received Node Life Time has elapsed 	 Check Node Life Time (Life Time Factor Guard Time) Check Node Guard pro- ducer CANopen node Increase Node Life Time Check cabling
PD0 Timer	 RPD0 Timer is set At least one valid PD0 message has been received RPD0 Timer has elapsed 	 Check RPD0 Timer time Check PD0 producer CANopen node Increase PD0 Timer time Check cabling

If any of the Table 118 fault situations occur (even if no fault is triggered in AC drive), the CANopen NMT state machine state can be affected. This is managed by object 0x1029:01 Communication Error. By default, the error response has value 0 = 0 Change to NMT state Pre-operational.

Any other fault (e.g. overtemperature), does not affect the NMT state machine. The object 0x1029:02 Internal Error is fixed to value 1 = No change to NMT state.

FAULT TRACING

9.3 DETAILED FAULT CODE

In VACON® 100 family a detailed fault code for fieldbuses is "Source3" in the fault history. This feature is available from firmware version V026 (INDUSTRIAL) and V018 (FLOW).

This information can be read with:

- Panel (4.1.x.26): Diagnostics 'Active Faults '"FB Timeout" 'Details 'Source 3
 Panel (4.3.x.26): Diagnostics 'Fault History '"FB Timeout" 'Details 'Source 3
- VACON® Live: View 'Fault Diagnostics 'Icon "Load active faults" 'Source3
- VACON® Live: View 'Fault Diagnostics 'Icon "Load fault history" 'Source3

Source3 fault codes are defined as follows:

Table 119. VACON® 100 family fieldbus fault Source3 codes

Code	Name	Description
1*	IO Watchdog	IO connection closed after timeout occurred
2*	IO Connection Closed	IO connection closed by fieldbus master
3*	Explicit Messaging Watchdog	Explicit messaging connection (other than cyclic IO data) closed after timeout occurred
4*	Explicit Messaging Connection Closed	Explicit messaging connection closed by fieldbus master
5*	Cable Disconnected	Fieldbus cable disconnected after device startup
6*	Cable Not Connected	Fieldbus cable was not connected after device startup
7*	Bad Data	Master IO data has changed from GOOD to BAD
8*	Idle State	Connection status changed to IDLE when motor is controlled
9*	Internal System Fault	Internal fieldbus fault, contact technical support
10*	Too Many Bad Messages	Protocol has received too many bad messages in a row and closed the connection
11	CAN BUS-OFF	CAN driver is in BUS-OFF state
12	CAN Passive	CAN driver is in passive state
13*	No External Power	No external power detected
14	Heartbeat Consumer	Heartbeat consumer timeout occurred
15	Node Guard	Node guarding timeout occurred
16	PD0 Timer	PDO timer event timeout occurred

^{*} Not relevant to OPTE6 CANopen option board

In case multiple error situations occur at once, the fault that has happened first has its code shown as the Source3 fault code.

10. APPENDIX A: OBJECT DICTIONARY

10.1 COMMUNICATION SEGMENT

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default value	Unit
		0	bject 1000	h: Device Type				
1000	0	Device type	Variable	UNSIGNED32	CONST	No	0x00010192	
		Ob	ject 1001h	: Error Register				
1001	0	Error Register	Variable	UNSIGNED8	RO	No	0x00	
		Object '	1003h: Pre	-defined Error Fiel	ld			
1003		Pre-defined Error Field	Array	UNSIGNED32				
	000	Number of Errors		UNSIGNED8	RW	No	0x00000000	
	001	Standard Error Field		UNSIGNED32	RO	No	0x0000000	
	002	Standard Error Field		UNSIGNED32	RO	No	0x0000000	
	003	Standard Error Field		UNSIGNED32	RO	No	0x0000000	
	004	Standard Error Field		UNSIGNED32	RO	No	0x0000000	
	005	Standard Error Field		UNSIGNED32	RO	No	0x0000000	
	006	Standard Error Field		UNSIGNED32	R0	No	0x0000000	
	007	Standard Error Field		UNSIGNED32	R0	No	0x0000000	
	800	Standard Error Field		UNSIGNED32	RO	No	0x0000000	
	009	Standard Error Field		UNSIGNED32	R0	No	0x0000000	
		Ot	ject 1005h	n: COB-ID SYNC				
1005	0	COB-ID SYNC	Variable	UNSIGNED32	RW	No	0x00000080	
		0	bject 100C	h: Guard Time				
100C	0	Guard Time	Variable	UNSIGNED16	RW	No	0x00000000	ms
		Obje	ect 100Dh:	Life Time Factor				
100D	0	Life Time Factor	Variable	UNSIGNED8	RW	No	0x00000000	
		Object	1010h: Sto	ore Parameter Fiel	d			
1010		Store Parameter Field	Array	UNSIGNED32				
	000	Number of Entries		UNSIGNED8	R0	No	0x2	
	001	Save all Parameters		UNSIGNED32	RW	No	-	
		Object 10	11h: Resto	re Default Parame	ters			
1011		Restore Default Parameters	Array	UNSIGNED32				
	000	Number of Entries		UNSIGNED8	R0	No	0x4	
	001	Restore all Default Parame- ters		UNSIGNED32	RW	No	-	
	004	Restore Bypass parameter set		UNSIGNED32	RW	No	-	
		Ob	ject 1014h	n: COB-ID EMCY				
1014	0	COB-ID EMCY	Variable	UNSIGNED32	RW	No	0x80	
		Object 101	l6h: Heart	beat Consumer Ent	ries			

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default value	Unit
1016		Heartbeat Consumer Entries	Array	UNSIGNED32				
	000	Number of Entries		UNSIGNED8	R0	No	0x08	
	001	Consumer Heartbeat Time 1		UNSIGNED32	RW	No	0x0000000	
	002	Consumer Heartbeat Time 2		UNSIGNED32	RW	No	0x0000000	
	003	Consumer Heartbeat Time 3		UNSIGNED32	RW	No	0x0000000	
	004	Consumer Heartbeat Time 4		UNSIGNED32	RW	No	0x0000000	
	005	Consumer Heartbeat Time 5		UNSIGNED32	RW	No	0x0000000	
	006	Consumer Heartbeat Time 6		UNSIGNED32	RW	No	0x0000000	
	007	Consumer Heartbeat Time 7		UNSIGNED32	RW	No	0x0000000	
	008	Consumer Heartbeat Time 8		UNSIGNED32	RW	No	0x0000000	
		Object 1	017h: Prod	ducer Heartbeat Tim	ne	<u>'</u>		
1017	0	Producer Heartbeat Time	Variable	UNSIGNED16	RW	No	0x00000000	
		Ob	ject 1018h	: Identity Object				
1018		Identity Object	Record	IDENTITY				
	000	Number of Entries		UNSIGNED8	R0	No	0x4	
	001	Vendor Id		UNSIGNED32	R0	No	0x90	
	002	Product Code		UNSIGNED32	R0	No	-	
	003	Revision number		UNSIGNED32	R0	No	-	
	004	Serial number		UNSIGNED32	R0	No	-	
		Object	: 1019h: Sy	nchronous counter				
1019	0	Synchronous counter	Variable	UNSIGNED8	RW	No	0x00000000	
		Obje	ect 1029h:	Error Behaviour				
1029		Error Behaviour	Array	UNSIGNED8				
	000	Number of Entries		UNSIGNED8	R0	No	0x1	
	001	Communication Error		UNSIGNED8	RW	No	0x0	
	002	Internal Error		UNSIGNED8	RW	No	0x1	
		Object 1400h: Re	ceive PD0	Communication Pa	rameter	1		
1400		Receive PDO Communiction Parameter 1	Record	PDO_COMM_PAR				
	000	Number of Entries		UNSIGNED8	R0	No	0x05	
	001	COB-ID		UNSIGNED32	RW	No	0x200	
	002	Transmission Type		UNSIGNED8	RW	No	0xFE	
	003	Inhibit Time		UNSIGNED16	RW	No	0x0	100 µs
	h — — —		t -		1			

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default value	Unit
1401		Receive PDO Communiction Parameter 2	Record	PDO_COMM_PAR				
	000	Number of Entries		UNSIGNED8	R0	No	0x05	
	001	COB-ID		UNSIGNED32	RW	No	0x80000300	
	002	Transmission Type		UNSIGNED8	RW	No	0xFE	
	003	Inhibit Time		UNSIGNED16	RW	No	0x0	100 µs
	005	Event Timer		UNSIGNED16	RW	No	0x0	ms
		Object 1402h: Re	ceive PD0	Communication Pa	rameter	3	<u></u>	
1402		Receive PDO Communiction Parameter 3	Record	PDO_COMM_PAR				
	000	Number of Entries		UNSIGNED8	R0	No	0x05	
	001	COB-ID		UNSIGNED32	RW	No	0x80000400	
	002	Transmission Type		UNSIGNED8	RW	No	0xFE	
	003	Inhibit Time		UNSIGNED16	RW	No	0x0	100 µs
	005	Event Timer		UNSIGNED16	RW	No	0x0	ms
	T	Object 1600h	: Receive	PDO Mapping Param	neter 1			
1600		Receive PDO Mapping Param- eter 1	Record	PDO_MAPPING				
	000	Number of Entries		UNSIGNED8	RW	No	0x02	
	001	Mapping Entry 1		UNSIGNED32	RW	No	0x60400010	
	002	Mapping Entry 2		UNSIGNED32	RW	No	0x60420010	
	003	Mapping Entry 3		UNSIGNED32	RW	No	0x00000000	
	004	Mapping Entry 4		UNSIGNED32	RW	No	0x00000000	
	ı	Object 1601h	: Receive	PDO Mapping Param	neter 2		r	
1601		Receive PDO Mapping Param- eter 2	Record	PDO_MAPPING				
	000	Number of Entries		UNSIGNED8	RW	No	0x04	
	001	Mapping Entry 1		UNSIGNED32	RW	No	0x20000410	
	002	Mapping Entry 2		UNSIGNED32	RW	No	0x20000510	
	003	Mapping Entry 3		UNSIGNED32	RW	No	0x20000610	
	004	Mapping Entry 4		UNSIGNED32	RW	No	0x20000710	
		Object 1602h	: Receive	PDO Mapping Param	neter 3	T	T	
1602		Receive PDO Mapping Param- eter 3	Record	PDO_MAPPING				
	000	Number of Entries		UNSIGNED8	RW	No	0x04	
	001	Mapping Entry 1		UNSIGNED32	RW	No	0x20000810	
	002	Mapping Entry 2		UNSIGNED32	RW	No	0x20000910	
	003	Mapping Entry 3		UNSIGNED32	RW	No	0x20000A10	
	004	Mapping Entry 4		UNSIGNED32	RW	No	0x20000B10	

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default value	Unit
1800		Transmit PD0 Communiction Parameter 1	Record	PDO_COMM_PAR				
	000	Number of Entries		UNSIGNED8	R0	No	0x06	
	001	COB-ID		UNSIGNED32	RW	No	0x180	
	002	Transmission Type		UNSIGNED8	RW	No	0xFE	
	003	Inhibit Time		UNSIGNED16	RW	No	0x64	100 µs
	005	Event Timer		UNSIGNED16	RW	No	0x0	ms
	006	Sync start value		UNSIGNED8	RW	No	0x0	
		Object 1801h: Tra	ınsmit PD(O Communication Pa	arameter	- 2		
1801		Transmit PDO Communiction Parameter 2	Record	PDO_COMM_PAR				
	000	Number of Entries		UNSIGNED8	R0	No	0x06	
	001	COB-ID		UNSIGNED32	RW	No	0x80000280	
	002	Transmission Type		UNSIGNED8	RW	No	0xFE	
	003	Inhibit Time		UNSIGNED16	RW	No	0x3E8	100 µs
	005	Event Timer		UNSIGNED16	RW	No	0x0	ms
	006	Sync start value		UNSIGNED8	RW	No	0x0	
		Object 1802h: Tra	nsmit PD(O Communication Pa	arameter	- 3		
1802		Transmit PD0 Communiction Parameter 3	Record	PDO_COMM_PAR				
	000	Number of Entries		UNSIGNED8	R0	No	0x06	
	001	COB-ID		UNSIGNED32	RW	No	0x80000380	
	002	Transmission Type		UNSIGNED8	RW	No	0xFE	
	003	Inhibit Time		UNSIGNED16	RW	No	0x3E8	100 μs
	005	Event Timer		UNSIGNED16	RW	No	0x0	ms
	006	Sync start value		UNSIGNED8	RW	No	0x0	
		Object 1A00h:	Transmit	PDO Mapping Parar	neter 1			
1A00		Transmit PDO Mapping Parameter 1	Record	PD0_MAPPING				
	000	Number of Entries		UNSIGNED8	RW	No	0x02	
	001	Mapping Entry 1		UNSIGNED32	RW	No	0x60410010	
	002	Mapping Entry 2		UNSIGNED32	RW	No	0x60440010	
	003	Mapping Entry 3		UNSIGNED32	RW	No	0x00000000	
	004	Mapping Entry 4		UNSIGNED32	RW	No	0x00000000	
		Object 1A01h:	Transmit	PDO Mapping Parar	neter 2			
1A01		Transmit PDO Mapping Parameter 2	Record	PD0_MAPPING				
	000	Number of Entries		UNSIGNED8	RW	No	0x04	
	001	Mapping Entry 1		UNSIGNED32	RW	No	0x20010410	
	002	Mapping Entry 2		UNSIGNED32	RW	No	0x20010510	
	003	Mapping Entry 3		UNSIGNED32	RW	No	0x20010610	
	004	Mapping Entry 4		UNSIGNED32	RW	No	0x20010710	

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default value	Unit
		Object 1A02h:	Transmit	PDO Mapping Parai	neter 3			
1A02		Transmit PDO Mapping Parameter 3	Record	PDO_MAPPING				
	000	Number of Entries		UNSIGNED8	RW	No	0x04	
	001	Mapping Entry 1		UNSIGNED32	RW	No	0x20010810	
	002	Mapping Entry 2		UNSIGNED32	RW	No	0x20010910	
	003	Mapping Entry 3		UNSIGNED32	RW	No	0x20010A10	
	004	Mapping Entry 4		UNSIGNED32	RW	No	0x20010B10	

10.2 MANUFACTURER SEGMENT

Index	Sub-	Description	Object	Data Type	Access	PD0	Default	Unit
	index		Code			Mapping	value	
	l I		ct 2000h: I	FB Processdata In		ı		
2000		FB Processdata In	Array	UNSIGNED16				
	000	Number of Entries		UNSIGNED8	CONST	No	0xB	
	001	FB Control Word		UNSIGNED16	RWW	Yes	0x0	
	002	FB Control Word Extension		UNSIGNED16	RWW	Yes	0x0	
	003	FB Speed Reference		UNSIGNED16	RWW	Yes	0x0	
	004	FB Process Data In 1		UNSIGNED16	RWW	Yes	0x0	
	005	FB Process Data In 2		UNSIGNED16	RWW	Yes	0x0	
	006	FB Process Data In 3		UNSIGNED16	RWW	Yes	0x0	
	007	FB Process Data In 4		UNSIGNED16	RWW	Yes	0x0	
	800	FB Process Data In 5		UNSIGNED16	RWW	Yes	0x0	
	009	FB Process Data In 6		UNSIGNED16	RWW	Yes	0x0	
	010	FB Process Data In 7		UNSIGNED16	RWW	Yes	0x0	
	011	FB Process Data In 8		UNSIGNED16	RWW	Yes	0x0	
		Objec	t 2001h: F	B Processdata Out				
2001		FB Processdata Out	Array	UNSIGNED16				
	000	Number of Entries		UNSIGNED8	CONST	No	0xB	
	001	FB Status Word		UNSIGNED16	R0	Yes	0x0	
	002	FB Status Word Extension		UNSIGNED16	R0	Yes	0x0	
	003	FB Actual Speed		UNSIGNED16	R0	Yes	0x0	
	004	FB Process Data Out 1		UNSIGNED16	R0	Yes	0x0	
	005	FB Process Data Out 2		UNSIGNED16	R0	Yes	0x0	
	006	FB Process Data Out 3		UNSIGNED16	RO	Yes	0x0	
	007	FB Process Data Out 4		UNSIGNED16	RO	Yes	0x0	
	800	FB Process Data Out 5		UNSIGNED16	RO	Yes	0x0	
	009	FB Process Data Out 6		UNSIGNED16	RO	Yes	0x0	
	010	FB Process Data Out 7		UNSIGNED16	RO	Yes	0x0	
	011	FB Process Data Out 8		UNSIGNED16	RO	Yes	0x0	

Γ								
Index	Sub-	Description	Object	Data Type	Access	PD0	Default	Unit
	index		Code			Mapping	value	
		Ot	oject 2002l	n: FB Dummy In				
2002		FB Dummy In	Array	UNSIGNED16				
	000	Number of Entries		UNSIGNED8	CONST	No	0xB	
	001	FB Dummy In Offset 0		UNSIGNED16	RW	Yes	0x0	
	011	FB Dummy In Offset 10		UNSIGNED16	RW	Yes	0x0	
		Ob _.	ject 2003h	: FB Dummy Out				
2003			Array					
	000	Number of Entries		UNSIGNED8	CONST	No	0xB	
	001	FB Dummy Out Offset 0		UNSIGNED16	R0	Yes	0x0	
						•••		
	011	FB Dummy Ljt Offset 10		UNSIGNED16	R0	Yes	0x0	
		Object 2	2004h: Con	nmunication Timeo	ut			
2004	0	Communication Timeout	Variable	UNSIGNED16	RW	No	0x01	S
			Object 2	005h: Mode				
2005	0	Mode	Variable	UNSIGNED16	RW	No	0x0	

The objects from 0x2100 to 0x5FFF contain the device-specific parameters and monitor values defined in separate .EDS files. These files can be downloaded from http://drives.danfoss.com.

For more information refer to chapter 8.5.

10.3 DEVICE PROFILE SEGMENT

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default Value
		Ob		: Controword			
6040	0	Controlword	Variable	UNSIGNED16	RWW	Yes	-
		Ot	ject 6041h	: Statusword			
6041	0	Statusword	Variable	UNSIGNED16	R0	Yes	-
		Objec	ct 6042h: vl	Target Velocity			
6042	0	vl Target Velocity	Variable	INTEGER16	RWW	Yes	0x0000
		Object	t 6043h: vl	Velocity Demand			
6043	0	vl Velocity Demand	Variable	INTEGER16	R0	Yes	-
		Object 6	044h: vl Ve	locity Actual Value			
6044	0	vl Velocity Actual Value	Variable	INTEGER16	R0	Yes	-
		Object 604	6h: vl Velo	city Min Max Amount			
6046		vl Velocity Min Max Amount	Array	UNSIGNED32			
	000	Number of Entries		CONST		No	0x00000002
	001	vl_Velocity_Min_Amount		UNSIGNED32	RW	No	0x2
	002	vl_Velocity_Max_Amount		UNSIGNED32	RW	No	-

Index	Sub- index	Description	Object Code	Data Type	Access	PD0 Mapping	Default Value
	muex	Object 6		locity Acceleration		· ·uppg	vatae
6048		vl Velocity Acceleration	Record	P402_VL_VEL_ACC_T			
	000	NumOfEntries		CONST		No	0x2
	001	DeltaSpeed		UNSIGNED32	RW	No	0x0
	002	DeltaTime		UNSIGNED16	RW	No	0x0
		Object 6	049h:vl Ve	locity Decelaration			
6049		vl Velocity Deceleration	Record	P402_VL_VEL_ACC_T			
	000	NumOfEntries		CONST		No	0x2
	001	DeltaSpeed		UNSIGNED32	RW	No	0x0
	002	DeltaTime		UNSIGNED16	RW	No	0x0
		Object	: 6060h: Mc	des of Operation			
6060	0	Modes of Operation	Variable	INTEGER8	RW	No	-
		Object 606	51h: Modes	of Operation Display			
6061	0	Modes of Operation Display	Variable	INTEGER8	R0	No	-
		Object 6	502h: Supp	orted Drive Modes			
6502	0	Supported Drive Modes	Variable	UNSIGNED32	R0	No	-

11. APPENDIX B - FIELDBUS PARAMETRIZATION

The following chapter describes briefly how to parametrize the AC drive in order for the motor to be controllable via fieldbus. These instructions are written for some basic applications. For more information, see the application-specific manual.

In order for the AC drive to accept commands from the fieldbus network, the control place of the AC drive has to be set to fieldbus. The default value of the parameter "Control Place" is usually I/O. Note that if the control unit software is updated, the default settings are restored. In addition, some applications may have the remote speed reference selection set by default to other than fieldbus. In these cases, the speed reference selection must be set to fieldbus, in order for the speed reference to be controlled via fieldbus.

NOTE! The motor control mode should be selected to support the used process and profile.

11.1 FIELDBUS CONTROL AND REFERENCE SELECTION

The following tables list some of the parameters related to fieldbus control in case of standard applications for the VACON® 100 family, VACON® NXP, VACON® 20 and VACON® 20X AC Drives. See the application specific manuals for more detailed information and latest updates.

The parameters can be read and written by using the drive panel, PC Tools or fieldbus protocol. For instructions on fieldbus writing, see the fieldbus specific manual.

Parameter name	ID	Value	Default	Panel Tree
Control mode	600	0 = Frequency 1 = Speed 2 = Torque	0	P3.1.2.1
Remote control place	172	1 = Fieldbus CTRL	0	P3.2.1
Local / remote	211	0 = Remote	0	P3.2.2
Fieldbus ref. sel.	122	3 = Fieldbus	3	P3.3.1.10
Controlling fieldbus	2539	1 = Automatic 2 = Slot D 3 = Slot E	1	P5.13.1

Table 120. Fieldbus parameterization for $VACON^{\otimes}$ 100 family (standard application)

Table 121. Fieldbus parametrization for VACON[®] 20 (standard application)

Parameter name	ID	Value	Default	Panel Tree
Motor control mode	600	0 = Frequency 1 = Speed 2 = Torque	0	P1.8
Rem. Control place 1 sel.	172	1 = Fieldbus CTRL	0	P2.1
Local / remote	211	0 = Remote	0	P2.5
Rem. Control place 1 freq. ref. sel.	122	3 = Fieldbus	7	P3.3

Parameter name ID **Value** Default **Panel Tree** 0 = Frequency Motor control mode 0 P8.1 600 1 = Speed 2 = Fieldbus Control place selection 125 0 P1.11 5 = Fieldbus 1819 0 P1.12 Frequency ref. sel.

Table 122. Fieldbus parametrization for $VACON^{\otimes}$ 20X (multipurpose application)

Table 123. Fieldbus parametrization for $VACON^{\mathbb{R}}$ NXP (multipurpose application)

Parameter name	ID	Value	Default	Panel Tree
Motor control mode	600	0 = Frequency 1 = Speed 2 = Torque	0	P2.6.1
Control place selection	125	3 = Fieldbus	1	P3.1
Frequency ref. sel.	122	9 = Fieldbus	3	P2.1.13

11.1.1 CONTROLLING FIELDBUS PARAMETER

In VACON[®] 100 family products, if multiple fieldbus options or protocols are active at once, use the "Controlling Fieldbus"-parameter to select the instance from which the process data is sent to the drive application. This parameter is located under I/O and Hardware / Fieldbus General (5.13.1).

By default, the setting is in "Automatic" and the functionality (when receiving process data from multiple sources) is application dependent.

For example, if a fieldbus option board has been installed to slot E and it is used with to control the drive, user can select "Slot E" as value for this parameter. Now only the process data from the option board in slot E is forwarded to the application. All other fieldbuses will still receive process data out. With this setting it is possible to prevent that the monitoring fieldbuses accidentally write process data in.

Table 124.

Value name	Value	Description
Automatic	1	Process data from all sources is forwarwed to application
Slot D	2	Only process data from slot D is forward to application. Value is visible only, if option board is installed to slot D.
Slot E	3	Only process data from slot E is forward to application. Value is visible only, if option board is installed to slot E.
RS485	4	Only process data from VACON® 100 family internal RS 485 protocol is forwarded to application
PROFINET IO	5	Only process data from VACON® 100 family internal PROFINET IO protocol is forwarded to application
EtherNet/IP	6	Only process data from VACON® 100 family internal Ether-Net/IP protocol is forwarded to application

Table 124.

Value name	Value	Description
Modbus TCP/ UDP	7	Only process data from VACON® 100 family internal Modbus TCP/UDP protocol is forwarded to application
Bacnet IP	8	Only process data from VACON® 100 family internal Bacnet IP protocol is forwarded to application

11.2 RESPONSE TO FIELDBUS FAULT

In case of a fieldbus fault (loss of connection etc.), a fieldbus fault is triggered. This fault can be parameterized in application to result in a desired response. Always check the application specific manual for details as responses vary between used applications. For common fault responses used commonly in standard applications, see the table below.

Table 125. Response to fieldbus fault in VACON® AC drives

ID	AC Drive	Value	Default	Panel Tree
	VACON [®] 100 family	0 = No action 1 = Alarm 2 = Alarm + preset frequency	3	P3.9.1.6
	VACON® 20	3 = Fault: Stop function 4 = Fault: Coast	3	P13.19
733	VACON [®] 20 X	0 = No action 1 = Warning 2 = Fault	2	P9.15
	VACON® NXP	0 = No action 1 = Warning 2 = Fault: Stop function 3 = Fault: Coast	2	P2.7.22

12. APPENDIX C - FIELDBUS PROCESS DATA MAPPING AND SCALING

Fieldbus process data items can be used to write and read variables quickly and periodically to/from VACON® AC drives. Incoming process data can be used for multiple different purposes (e.g. torque reference), and outgoing process data can be used for information about the state of the AC drive.

For fast access to any VACON[®] AC drive application ID over any fieldbus, generic Process Data Out parameters are defined. The content of the process data items are selected with the FB DataOut Sel parameters. Writing any application ID number to these parameters will then map the data value of that application ID to be sent in the corresponding Process Data Out variable.

Figure 19 illustrates how the fieldbus data mapping (FB DataOut x Sel) affects the data of the corresponding Process Data Out variable. By writing ID value 1 to FB DataOut1 Sel (ID 852), the value of ID 1 (Output Frequency) is sent in Process Data Out 1. The value is always raw value in process data out, so e.g. 16.43 Hz has value 1643. The scaling of the parameters can be checked from application manuals.

The status word and actual speed values cannot be changed, however the values sent by the fieldbus protocol might differ if a profile is used. In Bypass mode, these values are given as is.

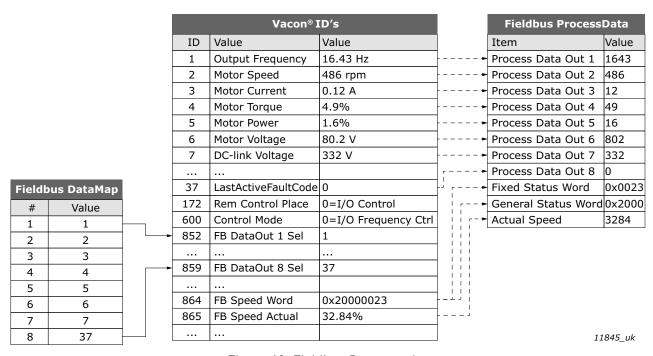


Figure 19. Fieldbus Datamapping

Table 126. Fieldbus Process Data Selection Panel Tree for VACON® AC drives

		Panel Tree						
Parameter name	ID	VACON [®] 100 family	VACON® NXP **	VACON® 20	VACON [®] 20 X/CP			
FB DataOut 1 Selection	852	P3.6.1	P2.13.3	P10.1	P11.1			
FB DataOut 2 Selection	853	P3.6.2	P2.13.4	P10.2	P11.2			
FB DataOut 8 Selection	859	P3.6.8	P2.13.10	P10.8	P11.8			
FB DataOut 9 Selection*	*	-	*	-	-			

Table 126. Fieldbus Process Data Selection Panel Tree for VACON® AC drives

		Panel Tree						
Parameter name	ID	VACON® 100 family	VACON® NXP **	VACON® 20	VACON® 20 X/CP			
FB DataOut 10 Selection*	*	-		-	-			
		-		-	-			
FB DataOut 16 Selection*	*	-		-	-			

^{*} Only in applications supporting fast communication

Table 127. Default process data mapping for VACON® 100 family and VACON® NXP

	VACON® 100 far		VACON® NXF						
PD	Mapped Application Data	ID	Unit	Scale	PD	Mapped Application Data	ID	Unit	Scale
1	Output Frequency	1	Hz	0.01 Hz	1	Output Frequency	1	Hz	0.01 Hz
2	Motor Speed	2	rpm	1 rpm	2	Motor Speed	2	rpm	1 rpm
3	Motor Current	3	Α	Varies*	3	Motor Current	45	Α	0.1 A
4	Motor Torque	4	%	0.1 %	4	Motor Torque	4	%	0.1 %
5	Motor Power	5	%	0.1 %	5	Motor Power	5	%	0.1 %
6	Motor Voltage	6	V	0.1 V	6	Motor Voltage	6	V	0.1 V
7	DC Link Voltage	7	V	1 V	7	DC Link Voltage	7	V	1 V
8	Last Active Fault Code	37	-	-	8	Last Active Fault Code	37	-	-

^{*}Scaling is based on drive nominal power. Scaling can be seen from Table 41.

Table 128. Default process data mapping for VACON $^{\circledR}$ 20 X/CP and VACON $^{\circledR}$ 20

	VACON® 20 X/	CP			VACON® 20				
PD	Mapped Application Data	ID	Unit	Scale	PD	Mapped Application Data	ID	Unit	Scale
1	Output Frequency	1	Hz	0.01 Hz	1	Frequency Reference	25	Hz	0.01 Hz
2	Motor Speed	2	rpm	1 rpm	2	Output Reference	1	Hz	0.01 Hz
3	Motor Current	3	Α	Varies*	3	Motor Speed	2	rpm	1 rpm
4	Motor Torque	4	%	0.1 %	4	Motor Voltage	6	V	0.1 V
5	Motor Power	5	%	0.1 %	5	Motor Torque	4	%	0.1 %
6	Motor Voltage	6	V	0.1 V	6	Motor Current	3	Α	Varies*
7	DC Link Voltage	7	V	1 V	7	Motor Power	5	%	0.1 %
8	Last Active Fault Code	37	-	-	8	DC Link Voltage	7	V	1 V

^{*} Scaling is based on drive nominal power. Scaling can be seen from Table 129.

^{**} Multipurpose application

Table 129. Current scaling based on nominal power

Nominal power	Current scale
< 5 kW	0.01 A
5 - 100 kW	0.1 A
> 100 kW	1 A

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