

**VACON<sup>®</sup> 100 INDUSTRIAL**  
**VACON<sup>®</sup> 100 FLOW**  
**VACON<sup>®</sup> 100 HVAC**  
**VACON<sup>®</sup> 100 X**  
**AC DRIVES**

**I/O OPTION BOARDS TYPE 'B' AND 'F'**  
**USER MANUAL**

**DRIVE CENTRE**   
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## 1. GENERAL INFORMATION

Vacon 100 product range embodies a wide selection of expander boards with which the available I/O of the AC drive can be increased and its versatility improved.

The input and output configuration (I/O) of Vacon 100 is designed with modularity in mind. The total I/O is comprised of basic and option boards, each having its own input and output configuration. The boards contain analogue and digital inputs and outputs and additional application-specific hardware.

The option boards are placed in the board slots on the AC drive. The I/O boards are usually interchangeable between different drive types, i.e. Vacon 100 and Vacon NX series. However, the control boards of these types differ from each other to some extent which means that the use of some I/O boards in different Vacon AC drive types may be restricted.

### 1.1 BOARD SLOTS ON VACON 100

The control board is situated inside the control unit of the Vacon 100 drive. There are two board slots (labelled D and E) on the Vacon 100X control board and three board slots (labelled C, D and E) on the Vacon 100, Vacon 100 FLOW and Vacon 100 HVAC control board. To locate the slots, see page 10. See also the descriptions of the option boards in Chapter 3.

Usually, when the AC drive is delivered from the factory, the control unit includes at least the standard board, which is installed in the standard board slot. The I/O boards mounted at the factory are indicated in the type code of the AC drive. The expander slots D, E (Vacon100X) and C, D, E (Vacon 100, Vacon 100 FLOW, Vacon 100 HVAC) are available for different option boards.

**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/>.

## 1.2 OPTION BOARD TYPE B

Type B option boards are used for I/O expansion. They are interchangeable with the boards of the same type used in Vacon NX series.

### 1.2.1 BOARD TYPE B TECHNICAL DATA

<b>Safety (all boards)</b>	Comply with EN50178, C-UL and EN60204-1 Inputs/outputs galvanically isolated; Isolation voltage rate 500 V
<b>Analogue inputs (AI), voltage</b>	0...+10 V, $R_i$ 200 $\Omega$ , single-ended; Resolution 10 bits/0.1%, accuracy $\pm 1\%$ of the full display
<b>Analogue inputs (AI), current</b>	0(4)...20 mA, $R_i$ = 250 $\Omega$ , differential Resolution 10 bits/0.1%, accuracy $\pm 1\%$ of the full display
<b>Digital inputs (DI), DC-controlled</b>	24 V: "0" < 10 V, "1" > 18 V, $R_i$ > 5 k $\Omega$
<b>Digital inputs (DI), AC-controlled</b>	Control voltage 42...240 VAC "0" < 33 V, "1" > 35 V
<b>Auxiliary voltage (output) (+24V)</b>	24 V ( $\pm 15\%$ ), max 250 mA (total summarized load from ext. +24 V outputs, max. 150 mA from one board.
<b>Auxiliary voltage (input) (ext. +24V)</b>	24 VDC ( $\pm 10\%$ , max. ripple voltage 100 mV RMS), max. 1 A. In special applications where PLC type functions are included in the control unit the input can be used as external auxiliary power supply for control boards as well as I/O boards.
<b>Reference voltage (output) (+10Vref)</b>	10 V - 0%...+2%, max. 10 mA
<b>Analogue output (AO), current (mA)</b>	0(4)...20 mA, $R_L$ < 500 $\Omega$ , resolution 10 bits/0.1%, accuracy $\pm 2\%$
<b>Analogue output (AO), voltage (V)</b>	0(2)...10 V, $R_L$ $\geq$ 1 k $\Omega$ , resolution 10 bits, accuracy $\pm 2\%$
<b>Relay outputs (RO)</b>	Switching capacity 24 VDC/8A 250 VAC/8A 125 VDC/0.4A Max. continuous load 2A rms Min. switching load: 5 V/10mA
<b>Thermistor input (TI)</b>	$R_{trip}$ = 4 k $\Omega$ (PTC type)

Table 1. Type B option boards, technical data

### 1.2.2 ISOLATION

The control connections are isolated from the mains potential and the I/O ground is connected directly to the frame of the AC drive. Digital inputs and relay outputs are isolated from the I/O ground. For digital input arrangements, see chapter "Digital input signal conversions" on page 4

### 1.2.3 ANALOGUE INPUTS

The analogue inputs of the type B boards can be used as either current inputs or voltage (mA/V) inputs (see detailed description of each board). The signal type is selected with a jumper block (B-type boards), or a dip switch (F-type boards) on the board. In case the voltage type input is used you still have to define the voltage range with another jumper block/dip switch. The factory default value for the analogue signal type is given in the description of the board. For detailed information, see the description of the board in question.

### 1.2.4 ANALOGUE OUTPUTS

The analogue outputs of option boards of type B are used with current (mA) signal only. However, on some certain option boards the signal type (mA/V) can be selected with a jumper/dip switch. See more detailed information on individual boards in chapter 3.

### 1.2.5 CONTROL VOLTAGE (+24V/EXT +24V)

The control voltage output +24 V/EXT+24 V can be used in two ways. Typically, the +24 V control voltage is wired to digital inputs through an external switch. The control voltage can also be used to power-up external equipment, such as encoders and auxiliary relays.

**Observe** that the specified total load on all available +24 V/EXT+24V output terminals must not exceed 250 mA.

The +24 V/EXT+24 V outputs can further be used to externally power up the control board as well as option boards. If an external power supply is connected to EXT+24 V output, the control board and option boards remain live even if mains should be lost on the AC drive. This ensures sufficient functioning of the control logic (not the motor control, however) and some alarms in exceptional power-loss situations. Furthermore, fieldbus links remain powered which enables e.g. the Fieldbus Master to read valuable data on the AC drive. **NOTE:** The power unit is not powered through the EXT+24 V and therefore the motor control does not work if the mains is lost.

Requirements for an external power back-up:

- output voltage +24DC±10%, max. ripple voltage 100 mV RMS
- max. current 1A
- 1A external fuse (no internal short-circuit protection on the control board)

**NOTE:** Analogue outputs and inputs do not work with only +24 V supplied to the control unit.

If there is a +24 V/EXT+24V output on the board it is short-circuit protected locally. Should one of the +24 V/EXT+24 V outputs shortcircuit, the others would remain powered because of the local protection.

### 1.2.6 DIGITAL INPUT SIGNAL CONVERSIONS

The active signal level depends on which potential the common input CMA is connected to. The alternatives are +24 V or Ground (0V). See 1, 2 and 3.

The 24-volt control voltage and the ground for the digital inputs and the common input (CMA) can be either internal or external.

Some typical input signal conversion examples are shown below. If you use the internal +24 V from the AC drive, the following arrangements are possible:

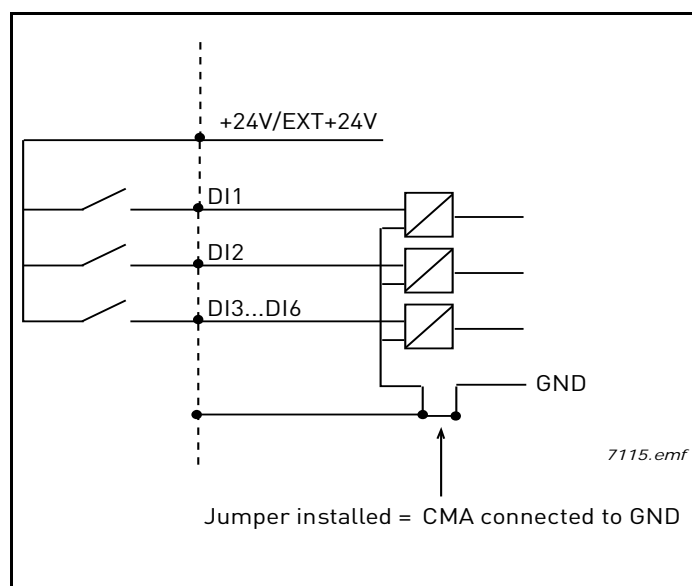


Figure 1. If CMA is connected to GND with inboard jumper the internal +24 V is used and the CMA terminal need not be wired

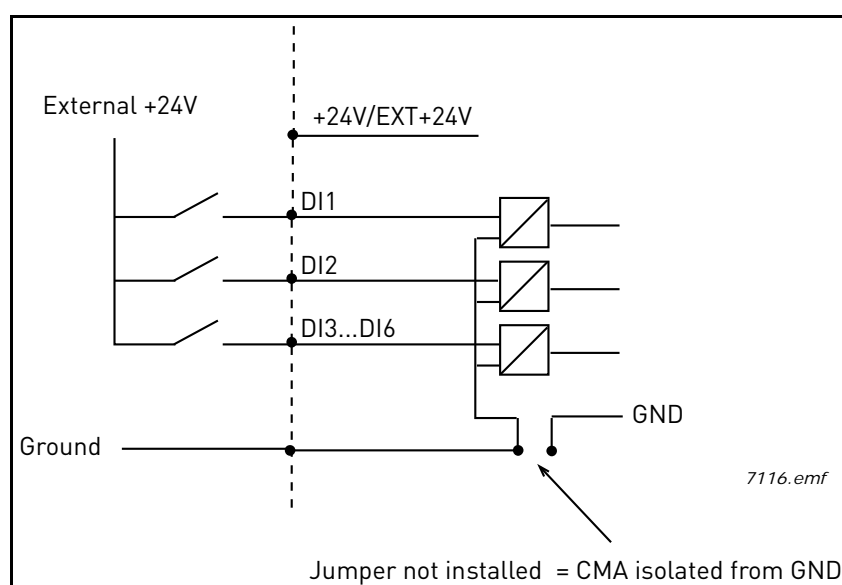


Figure 2. Positive logic with external +24 V when CMA is isolated from GND using onboard jumper. The input is active when the switch is closed.

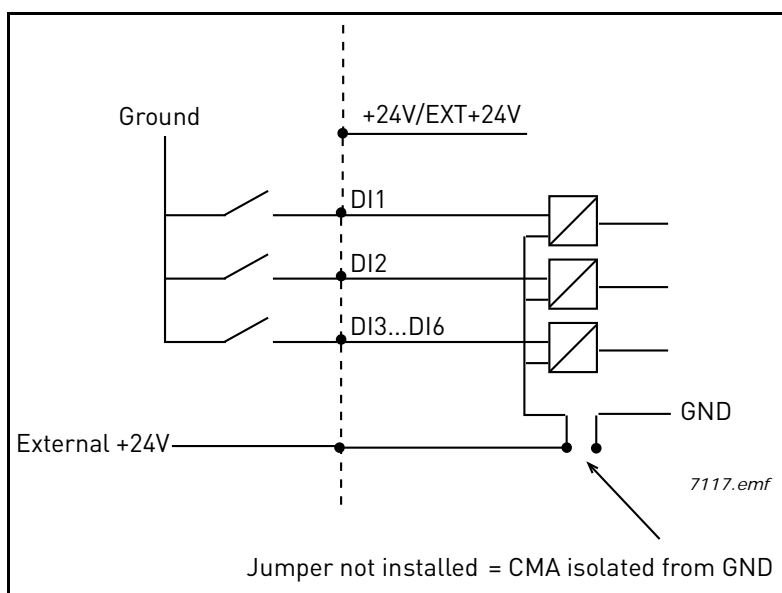


Figure 3. Negative logic with external +24 V when CMA is isolated with onboard jumper. The input is active when the switch is closed (0V is the active signal).

You can make the positive and negative logic arrangements also with the internal +24 V. Place the jumper block in the 'CMA isolated from GND' position (as above) and wire the CMA terminal to the GND terminal of the AC drive.



### 1.3 HARDWARE PROTECTIONS

#### 1.3.1 TERMINAL BLOCK CODING

In order to avoid incorrect connections of terminal blocks to boards, some terminal blocks as well as related terminal connectors on the board are uniquely coded. For more information, see the description of the individual board.

#### 1.4 TYPE IDENTIFICATION NUMBER

**NOTE:** This information is relevant only for special applications designers using the Vacon Programming engineering tool.

Each Vacon OPTxx board has a unique type designation code. Besides the type designation code, each board has a unique Type identification number which is used by the system program to identify which board is plugged into the board slot. The system program and the application use the Type ID also to establish the needed connections in order to achieve the desired functionality of the available I/O boards in the control unit. The ID code is loaded in the memory of the board.

### 1.5 DEFINING FUNCTIONS TO INPUTS AND OUTPUTS - PROGRAMMING

The programming of digital inputs and outputs is very flexible. There are no digital terminals assigned only for certain function. You can choose the terminal of your choice for the certain function, in other words, functions appear as parameters which the operator defines a certain input for.

#### 1.5.1 EXAMPLE PROGRAMMING

The selectable values of the parameters programmed are of type

**DigIN SlotA.1**

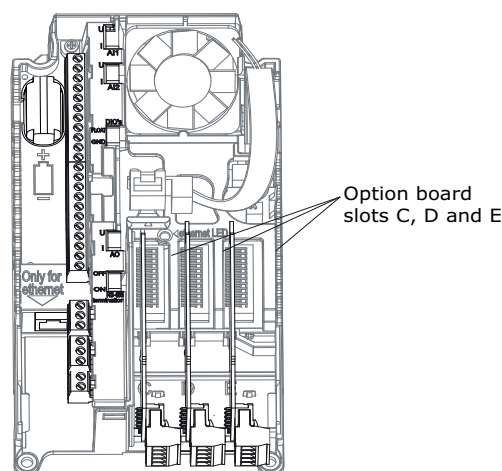
in which

'DigIN' stands for digital input.

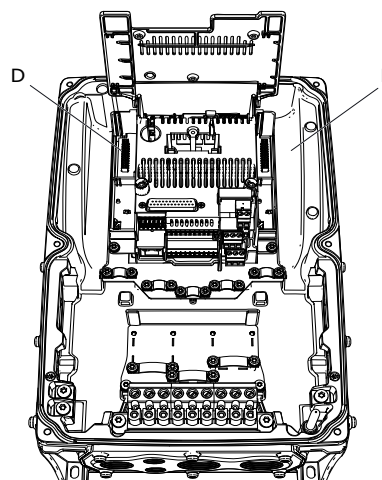
'Slot\_' refers to the board; either Vacon AC drive basic boards, or **C**, **D** and **E** which are option boards (see Figure 4). If the word "slot" is followed by a '0' (for example **DigIN Slot0.1**), the parameter (signal) is not connected to any terminal, i.e. the signal is not used in the system.

**The number** after the board letter refers to the respective terminal on the selected board. Hence, **DigIN SlotA.1** means terminal DI1 on the in-built basic board in board slot A.

**Vacon 100, Vacon 100 FLOW, Vacon 100 HVAC**



**Vacon 100X**



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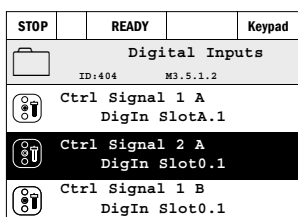
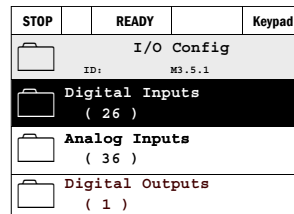
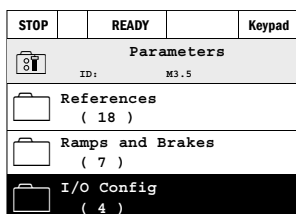
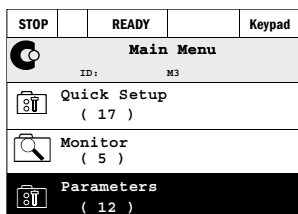
Figure 4. Option board slots

**EXAMPLE:**

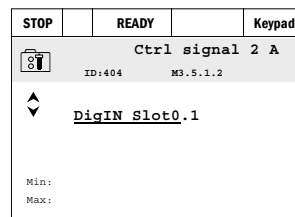
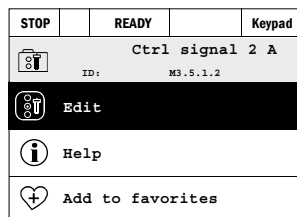
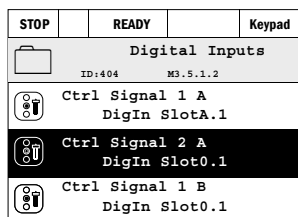
You want to connect the *Control signal 2 A* (parameter M3.5.1.2) to digital input DI2.

**1**

Locate the parameter *Control signal 2 A* (M3.5.1.2) on the keypad.

**2**

Enter the *Edit* mode.

**3**

**Change the value:** The editable part of the value (DigIN Slot0.1) is underlined and blinking. Change the slot or assign to Time Channel with the arrow keys up and down. Make the terminal value (.1) editable by pressing the right key once and change the value with arrow keys up and down.

Accept the change with OK button or return to previous menu level with BACK/RESET button.



Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.

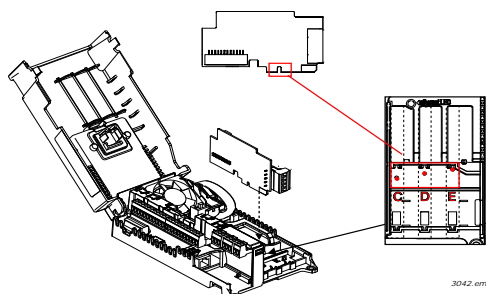
**NOTE!**

The assignment of the inputs, unlike of the outputs, cannot be changed in RUN state.

## 2. INSTALLATION OF OPTION BOARDS

With B-type boards, make sure that the sticker on the connector of the board says “dv” (dual voltage). This indicates that the board is compatible with Vacon drives mentioned in this manual. See below:

**NOTE:** Incompatible boards cannot be installed on Vacon drives. Compatible boards have a slot coding that enable the placing of the board (see below).



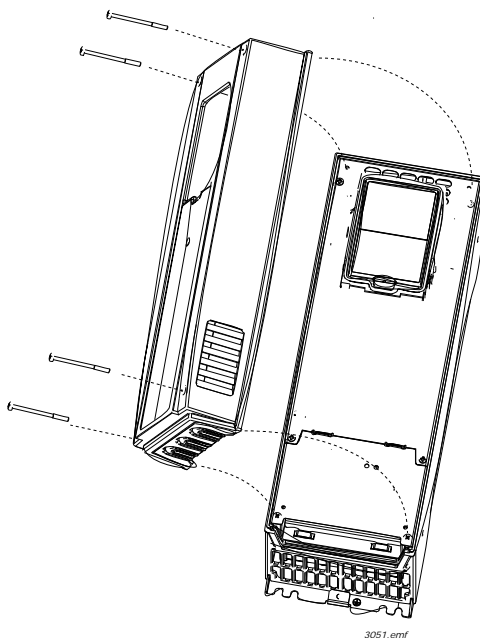
### 2.1 VACON 100, VACON 100 FLOW AND VACON 100 HVAC



**NOTE:** It is not allowed to add or replace option boards or fieldbus boards on a AC drive with the power switched on. This may damage the boards.

1

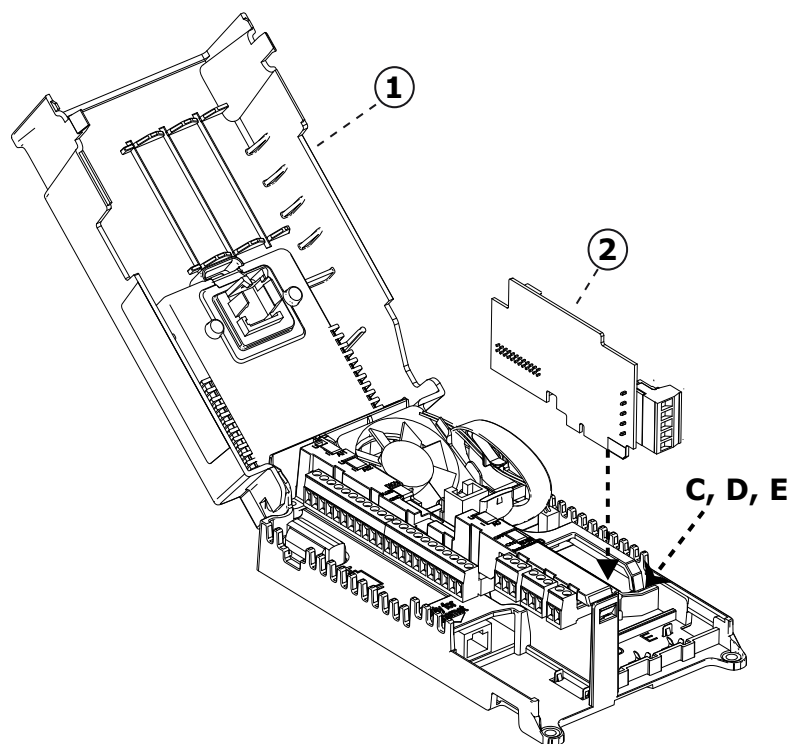
Open the cover of the AC drive.



The relay outputs and other I/O-terminals may have a dangerous control voltage present even when Vacon 100 is disconnected from mains.

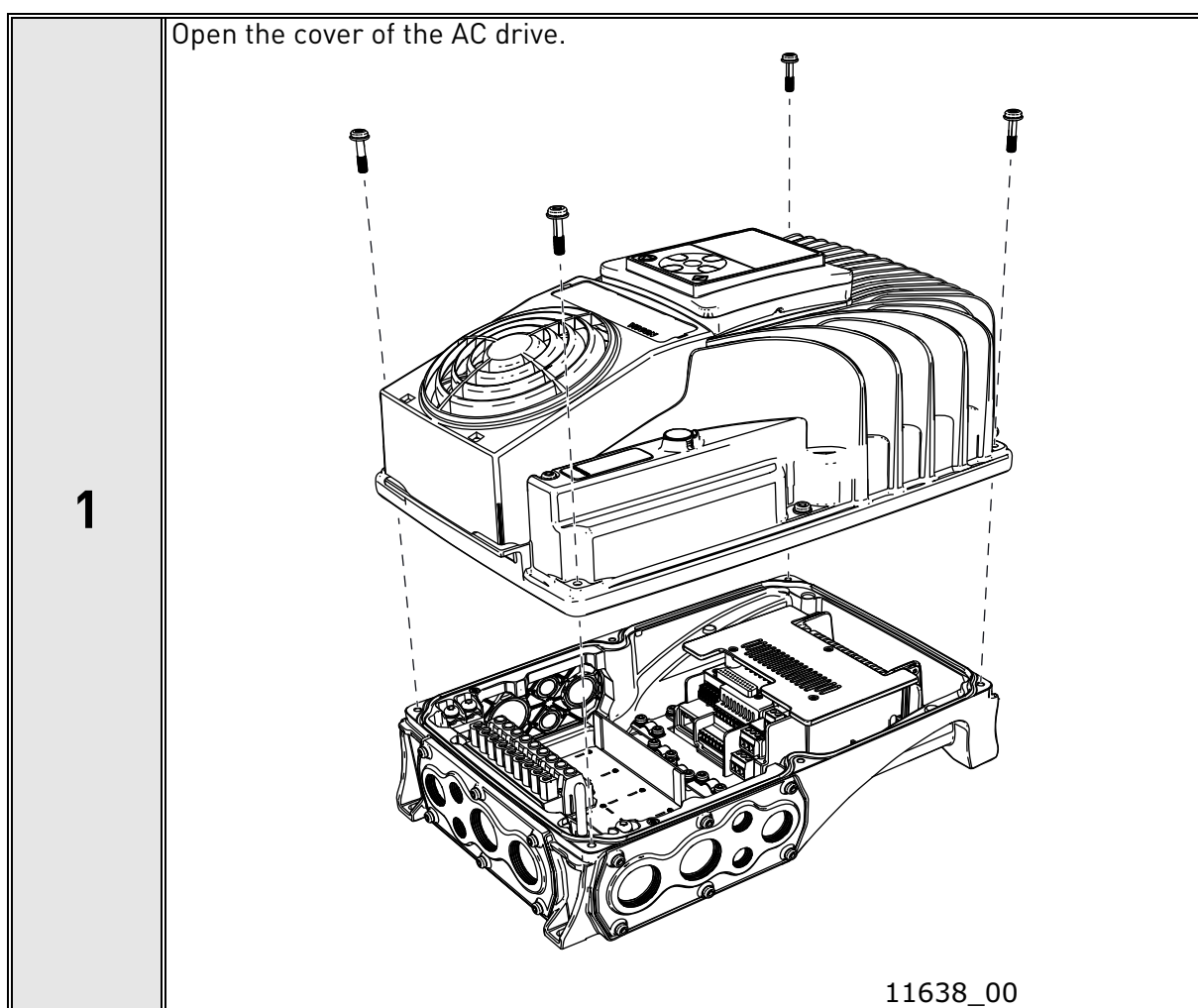
**2**

Open the inner cover **(1)** to reveal the option board slots **(C,D,E)** and install the option board **(2)** into slot **C, D** or **E**. Close the inner cover.



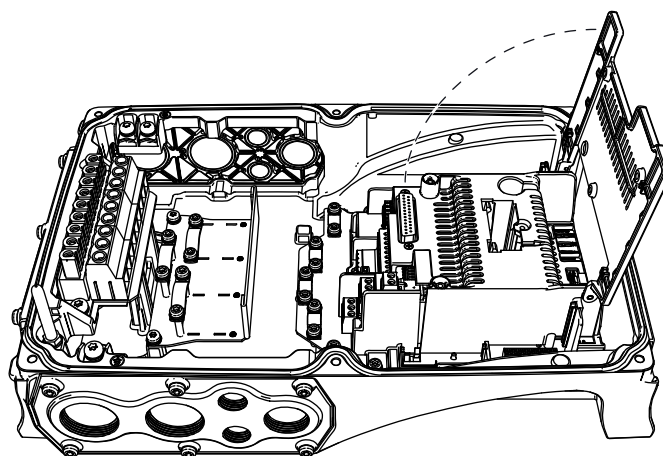
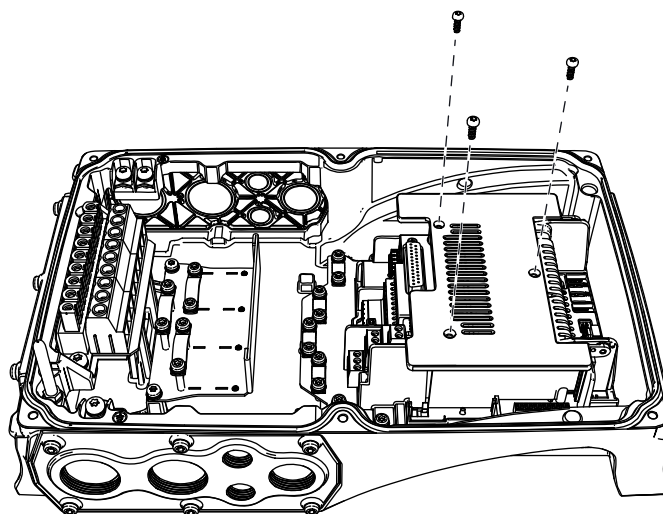
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## 2.2 VACON 100 X



2

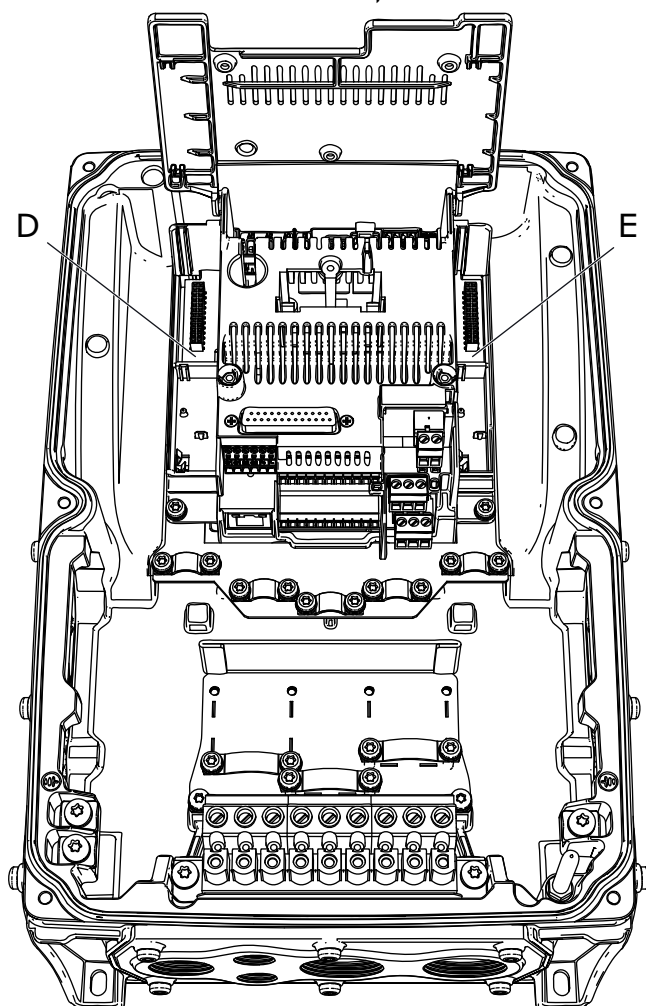
To get access to the option board slots, remove the screws and open the cover of the control unit.



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3

Install the option board into the correct slot, D or E.



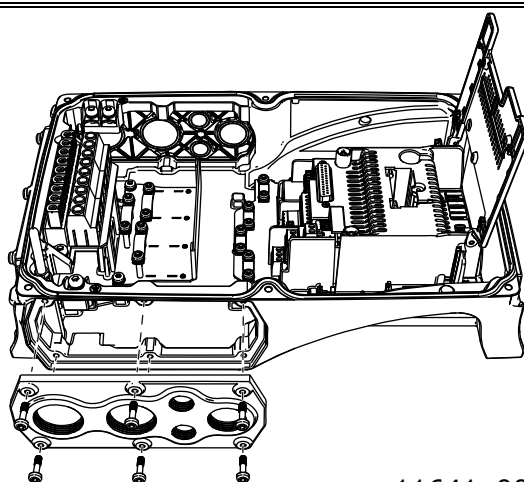
11640\_00

4

Close the option board cover.

5

Remove the cable entry plate if necessary, e.g. when using big cable plugs. Choose the proper entry plate (right, left, bottom) depending on the wiring plan. Make sure that the motor cables do not use the same entry plate as signal cabling.



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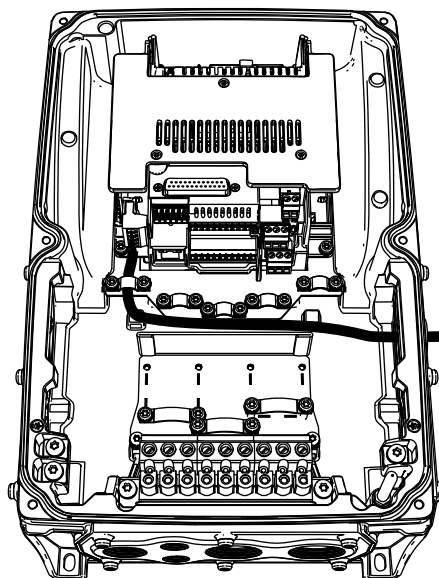
**6**

Open the necessary holes in the cable entry plate. Do not open the other holes. See the Vacon 100X Installation Manual for the dimensions of the holes.

**7**

Attach a cable gland on the hole in the cable entry plate. Pull the AS-interface cable through the hole.

**NOTE!** The AS-interface cable must go through the correct cable entry plate to avoid going near the motor cable.



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**8**

Put the cable entry plate back if it was removed during installation.

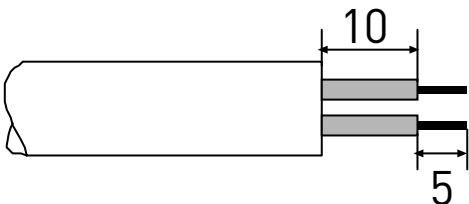
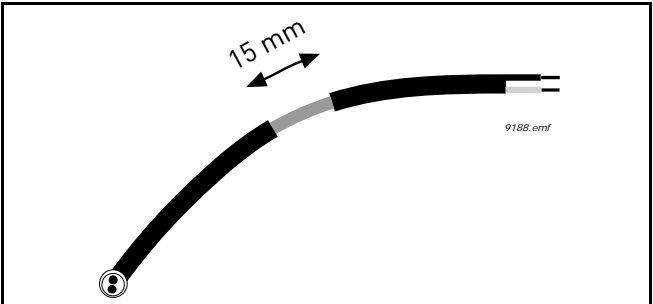
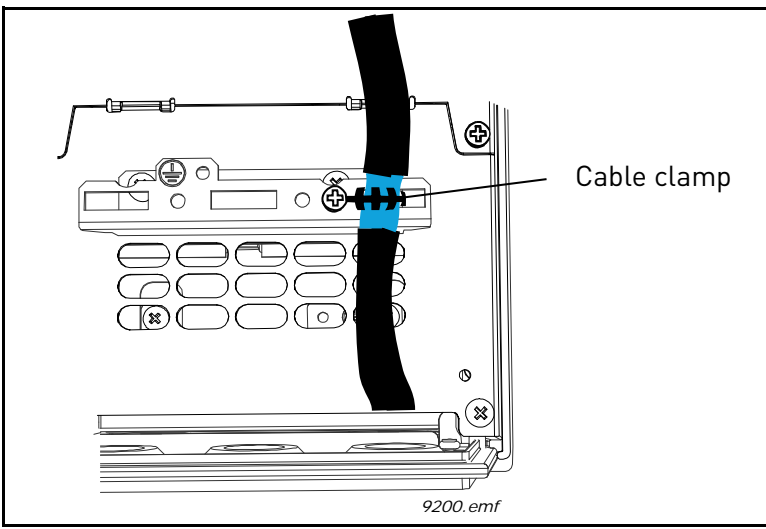
**9**

Close the cover of the AC drive.



## 2.3 PREPARE FOR USE

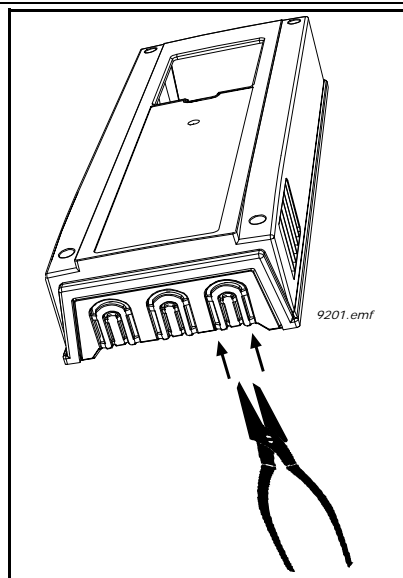
We recommend to ground the control cables in the manner presented below. Note that the images are suggestive, because the cables can vary.

<p>1</p>	<p>Strip about 15 mm of the cable and cut off the grey cable shield. Remember to do this for both cables.</p> <p>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.</p>  <p>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. <b>Do not strip the aluminum cable shield!</b></p> 
<p>2</p>	<p>Then connect the cable to its appropriate terminals on the option board terminal block.</p>
<p>3</p>	<p>Using the cable clamp included in the delivery of the drive, ground the shield of the option board cable to the frame of the AC drive.</p> 

4

Unless already done for the other control cables, cut free the opening on the AC drive cover for the option board cable (protection class IP21).

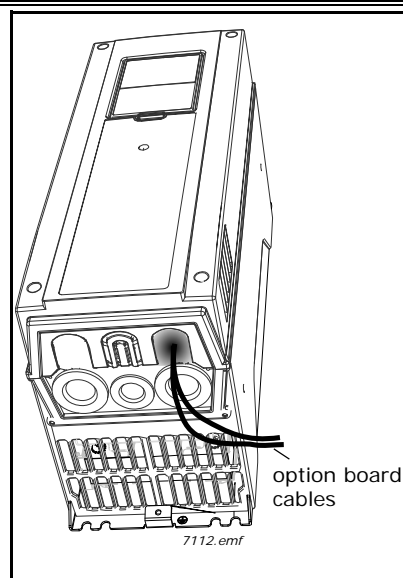
**NOTE:** Cut the opening on the same side you have installed the board in!



5

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 option board 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 picture.



## 2.4 CONTROL CABLES

The control cables must be at least 0.5 mm<sup>2</sup> screened multicore cables. The maximum terminal wire size is 2.5 mm<sup>2</sup> for the relay terminals and other terminals.

Find the tightening torques of the control and relay board terminals in Table below.

Table 2. Control cable tightening torques

Terminal screw	Tightening torque	
	Nm	lb-in.
All I/O and relay terminals (screw M3)	0.45	4.00

Table 3: Cable types required to meet standards

Cable type	1 <sup>st</sup> environment	2nd environment	
	EMC levels According to EN61800-3 (2004)		
	Category C2	Category C3	Level T
Control cable	4	4	4

4 = Screened cable equipped with compact low-impedance shield (JAMAK, SAB/ÖZCuY-O or similar).

## 2.5 BOARD INFORMATION STICKER

Each I/O option board package delivered by the factory includes a sticker (shown below) where possible modifications made in the AC drive are noted. Write the board type, the slot in which it was mounted and the date on the sticker. Finally, attach the sticker on your drive.

<b>Product modified</b>	
	Date: .....
	Date: .....
	Date: .....

9004.emf